4600 Swath Bathymetry and Side Scan Sonar System

User Manual

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The Leader in Underwater Technology

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Warning—Read This First!

All personnel involved with the installation, operation, or maintenance of the equipment described in this manual should read and understand the warnings and recommendations provided below.

Static Sensitive Devices

This equipment contains devices that are extremely sensitive to static electrical charges. Therefore extreme care should be taken when handling them, as static electricity may be present on the body and clothing. Normal handling precautions involve the use of anti-static protection materials and grounding straps for personnel.

Radiation

This equipment generates, uses, and can radiate radio frequency energy. Therefore if the equipment is not installed properly, it may cause interference with radio communications. The equipment has not been tested for compliance with the appropriate FCC rules designed to provide reasonable protection against such interference when operated in a commercial environment. Therefore when operating the equipment in a residential area, the user may be required to take whatever measures are needed and incur any expenses necessary to eliminate interference; it is the user's responsibility to verify that the system complies with the applicable FCC emission limits.

High Voltages

High Voltage may be present in all parts of the system. Use caution when the electronics are removed from their containers for servicing.

Improper Line Voltage

Operation with improper line voltage may cause serious damage to the equipment. Always ensure that the proper line voltage is used.

Hardware Variations and Compatibility

The 4600 Swath Bathymetry and Side Scan Sonar System contains both standard PC and proprietary hardware. At times EdgeTech may change the standard components due to their availability or performance improvements. Although the component manufacturers, along with their models and styles may change from unit to unit, replacement components will generally be interchangeable.

EdgeTech will make every effort to see that replacement components are interchangeable and use the same software drivers. At times, however, direct replacements may not exist. When this happens, EdgeTech will provide the necessary drivers with the replacement part.

EdgeTech may also change certain hardware per customer requirements. Therefore, portions of this manual, such as parts lists and test features, are subject to change. These sections should be used for reference only. When changes are made that affect system operation, they will be explicitly noted. Also, some options and features may not be active in the customer's unit at time of delivery. Upgrades will be made available when these features are implemented.

Preface

We, the employees at EdgeTech, would like to thank you for purchasing a 4600 Swath Bathymetry and Side Scan Sonar System. At EdgeTech, it is our policy to provide high quality, cost effective products and support services that meet or exceed your requirements. We also strive to deliver them on time and to continuously look for ways to improve them. We take pride in the products we manufacture and want you to be entirely satisfied with your equipment.

Purpose of this Manual

The purpose of this manual is to provide the user with information on the setup, operation, care, and features of the EdgeTech 4600 Swath Bathymetry and Side Scan Sonar System. The system consists of a topside unit and a sonar head. For detailed information relating to the DISCOVER software included with the topside unit, refer to the appropriate user manual.

Although this manual encompasses the latest operational features of the 4600 Swath Bathymetry and Side Scan Sonar System, some features of the system may be periodically upgraded. Therefore the information in this manual is subject to change and should be used for reference only.

Summary of Sections

This manual is divided into the following five sections and three appendices:

SECTION 1: Overview and Options. Discusses the background and applications of the 4600 Swath Bathymetry and Side Scan Sonar System, as well as providing information about EdgeTech as a company.

SECTION 2: Components and Specifications. Explains the sonar head and topside processor specifications in detail.

SECTION 3: Set-up and Deployment. Discusses how to properly unpack, assemble, and deploy the system.

SECTION 4: Principles of Operation. Explains how to use the system.

SECTION 5: Frequently Asked Questions. Contains a list of common questions about the system and their corresponding answers.

APPENDIX A: Configuring the COM Ports. Describes the process for configuring the COM ports on the 4600.

APPENDIX B: Performing a Rub Test. Describes the procedure for performing a rub test to ensure that the system is working properly before deployment.

APPENDIX C: Diagrams. Includes wiring and acoustic center diagrams for the 4600 system.

Warnings, Cautions, and Notes

Where applicable, warnings, cautions, and notes are provided in this manual as follows:

> ***WARNING!***
>
> **Identifies a potential hazard that could cause personal injury or death to yourself or to others.**

> ***CAUTION!***
>
> **Identifies a potential hazard that could be damaging to equipment or could result in the loss of data.**

> **NOTE:** *Recommendations or general information that is particular to the material being presented. It may also refer to another part of this manual or to another manual.*

Liability

EdgeTech has made every effort to document in this manual the 4600 Swath Bathymetry and Side Scan Sonar System accurately and completely. However, EdgeTech assumes no liability for errors or for any damages that result from the use of this manual or the equipment it documents. EdgeTech reserves the right to upgrade features of this equipment and to make changes to this manual without notice at any time.

Warranty

All equipment manufactured by EdgeTech is warranted against defective components and workmanship for a period of one year after shipment. Warranty repair will be done by EdgeTech free of charge. Shipping costs are to be borne by the customer. Malfunction due to improper use is not covered in the warranty, and EdgeTech disclaims any liability for consequential damage resulting from defects in the performance of the equipment. No product is warranted as being fit for a particular purpose, and there is no warranty of merchantability. This warranty applies only if:

i. The items are used solely under the operating conditions and in the manner recommended in Seller's instruction manual, specifications, or other literature.

ii. The items have not been misused or abused in any manner, nor have repairs been attempted thereon without the approval of **EdgeTech Customer Service**.

iii. Written notice of the failure within the warranty period is forwarded to Seller and the directions received for properly identifying items returned under warranty are followed.

iv. The return notice authorizes Seller to examine and disassemble returned products to the extent Seller deems necessary to ascertain the cause for failure.

The warranties expressed herein are exclusive. There are no other warranties, either expressed or implied, beyond those set forth herein, and Seller does not assume any other obligation or liability in connection with the sale or use of said products. Any product or service repaired under this warranty shall be warranted for the remaining portion of the original warranty period only.

Equipment not manufactured by EdgeTech is supported only to the extent of the original manufacturer's warranties.

Software Service Agreement

EdgeTech provides software services free of charge.

The SSA does not address customer-specified modifications or enhancements. These services may be ordered separately. Furthermore, EdgeTech software upgrades are meant for the sole use of EdgeTech customer. Any reproduction of EdgeTech supplied software or file sharing is strictly prohibited.

Software Updates and Enhancements

EdgeTech customers can download new software releases with all modifications and enhancements along with user's manual changes from the EdgeTech ftp site. Major software issues, should they occur, will be reported directly to the customer. New software releases consist of the following:

- Software enhancements that are not on the price list
- Software fixes and changes
- Product integration
- Documentation updates to on-line help
- Tests for compatibility with other modules

Software patches consist of software that has undergone the following:

- Minor software enhancements
- Software fixes and changes

Software Performance Report

EdgeTech customers may submit reports using a Software Performance Report (SPR) form. SPR forms are available from EdgeTech. This report may be related to a problem or to an inquiry, or it may be a specific request for a software enhancement. EdgeTech will attend to the SPR at a priority level appropriate to the seriousness of the problem and to the availability of a work-around.

Software Telephone, Facsimile, and E-mail Support

The SSA entitles EdgeTech customers to contact **EdgeTech Customer Service** by telephone, facsimile, or e-mail to report a difficulty, to discuss a problem or to receive advice on the best way to perform a task. When contacted, EdgeTech Customer Service will do the following:

- Respond within 24 hours
- Immediately attend to serious problems affecting operations
- Attempt to find an immediate work-around

Returned Material Authorization

Prior to returning any equipment to EdgeTech, a Returned Material Authorization (RMA) number must be obtained. The RMA will help us identify your equipment when it arrives at our receiving dock and track the equipment while it is at our facility. The material should be shipped to the address provided in the **EdgeTech Customer Service** section. Please refer to the RMA number on all documents and correspondences as well.

All returned material must be shipped prepaid. Freight collect shipments will not be accepted.

The following steps apply ***only*** to material being returned from outside the Continental United States. Follow them carefully to prevent delays and additional costs.

1. All shipments must be accompanied by three copies of your proforma invoice, showing the value of the material and the reason for its return. If the reason is for repair, it must be clearly stated in order to move through customs quickly and without duties being charged. Whenever possible, please send copies of original export shipping documents with the consignment.

2. If the value of the equipment is over $1000, the following Shipper's oath must be sent with the invoice. This oath can be typed on the invoice, or on a separate letterhead.

   "I, _____, declare that the articles herein specified are the growth, produce, or manufacture of the United States; that they were exported from the United States from the port of _____, on or about _____; that they are returned without having been advanced in value or improved in condition by any process of manufacture or any other means; and that no drawback, or allowance has been paid or admitted hereof."

   Signed _____

3. If there is more than one item per consignment, a packing list must accompany the shipment. It is acceptable to combine the proforma invoice and packing list as long as the contents of each carton are clearly numbered and identified on the invoice.

4. Small items can be shipped prepaid directly to EdgeTech by FedEx, DHL, UPS, Airborne, etc.

5. If the equipment is the property of EdgeTech (formerly EG&G Marine Instruments Division), please insure for full value.

6. Fax one invoice, packing list, and a copy of the airway bill to EdgeTech upon shipment.

Customer Service

Customer service personnel at EdgeTech are always eager to hear from users of our products. Your feedback is welcome, and is a valuable source of information which we use to continually improve these products. Therefore we encourage you to contact EdgeTech Customer Service to offer any suggestions or to request technical support:

E-mail:	service@edgetech.com
Mail:	4 Little Brook Road West Wareham, MA 02576
Telephone:	(508) 291-0057, Ext 712
Facsimile:	(508) 291-2491
24-Hour Emergency Technical Support Line:	(508) 942-8043

For more information please go to www.EdgeTech.com.

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SECTION 1: OVERVIEW AND OPTIONS

EdgeTech's 4600 is a combined, fully-integrated, swath bathymetry and side scan sonar system. The 4600 uses eight receive element transducers and one discrete transmit element to produce real-time, high-resolution, bathymetric data, while also providing co-registered, simultaneous side scan data. The high number of channels enables good rejection of multi-path effects, reverberation, and acoustic noise.

Figure 1-1: 4600 Topside Processing Unit (left) and 4600 Sonar Head (right)

The 4600 operates at one of two frequencies, 230 kHz or 540 kHz, depending on the model. The sonar electronics and arrays are mounted onto a streamline body that is deployed over the bow (or side) of a survey vessel. Sonar data is transferred from the transceiver to the processing unit on board via an Ethernet network interface.

Default configuration for the 4600 includes an integrated sound velocity sensor and a built-in bottom tracker. The system can interface with standard DFPS/RTK systems, MRUs, SVPs, CTDs, Altimeters, and Gyros. Simple to use acquisition software is provided by EdgeTech, along with an approved post-processing software program.

The 4600 Topside Processing Unit comes standard with HYPACK® pre-installed as the default post-processing software unless the customer has specified otherwise upon time of purchase.

1.1 Company Background

EdgeTech (formerly EG&G Marine Instruments) traces its history in underwater data acquisition and processing back to 1966. For over 35 years, EdgeTech has designed, developed, and manufactured products, instruments, and systems for the acquisition of underwater data, including marine, estuarine, and coastal applications.

The company has responded to the needs of the scientific, Naval, and offshore communities by providing equipment, such as sub-bottom profilers, side scan sonar, acoustic releases, and positioning systems that have become standards in the industry.

Equally as significant is EdgeTech's ability to anticipate and respond to future needs through an active research and development program. Current efforts are focused on the application of cutting edge chirp, DSP, and acoustic technology.

1.2 4600 Applications

Applications of the 4600 Swath Bathymetry and Side Scan Sonar system include:

- Mine countermeasures
- Hydrographic surveys
- Cable and pipeline surveys
- Channel conditioning/clearance surveys
- Geological/geophysical surveys
- Route surveys
- Archaeological surveys

1.3 Supplied Components

The 4600 system comes supplied with the following standard components:

- 4600 Swath Bathymetry and Side Scan Sonar System with 20 m (65 ft) Deck Cable (please refer to the Cable Drawing in **APPENDIX C:**).
- Sound Velocity Sensor (SVS, located in the nose section of the Sonar Head)
- 4600 Topside Processing Unit – 4600 Interface and Topside Processor with DISCOVER 4600 Bathymetry and Side Scan Acquisition Software

- HYPACK® Survey and Post-Processing Software (unless otherwise specified at time of purchase)
- System Restore Software (DVD)
- 2 x HP 21 in LCD Monitors
- HP Keyboard and Mouse
- 2 x Power Cables
- Spares Kit

NOTE: *Customer is to provide cable path between the 4600 Topside Processor Unit and the Sonar Head*

1.4 Optional Equipment

The following list of optional equipment is available for the 4600 system:

- 4600 Mounting Pole (see Figure 1-2)
- Crescent VS111 Series Hemisphere GPS (Figure 1-3)
- SMC IMU Sensor (Figure 1-4)
- Coda F175 Presition Attitude and Position Sensor
- HP 25 in LCD Monitor
- Samsung 25 in LCD Monitor
- Hard Copy of Manuals

NOTE: *Customer must specify their request for optional equipment at the time of purchase.*

1.4.1 Optional Mounting Pole Example

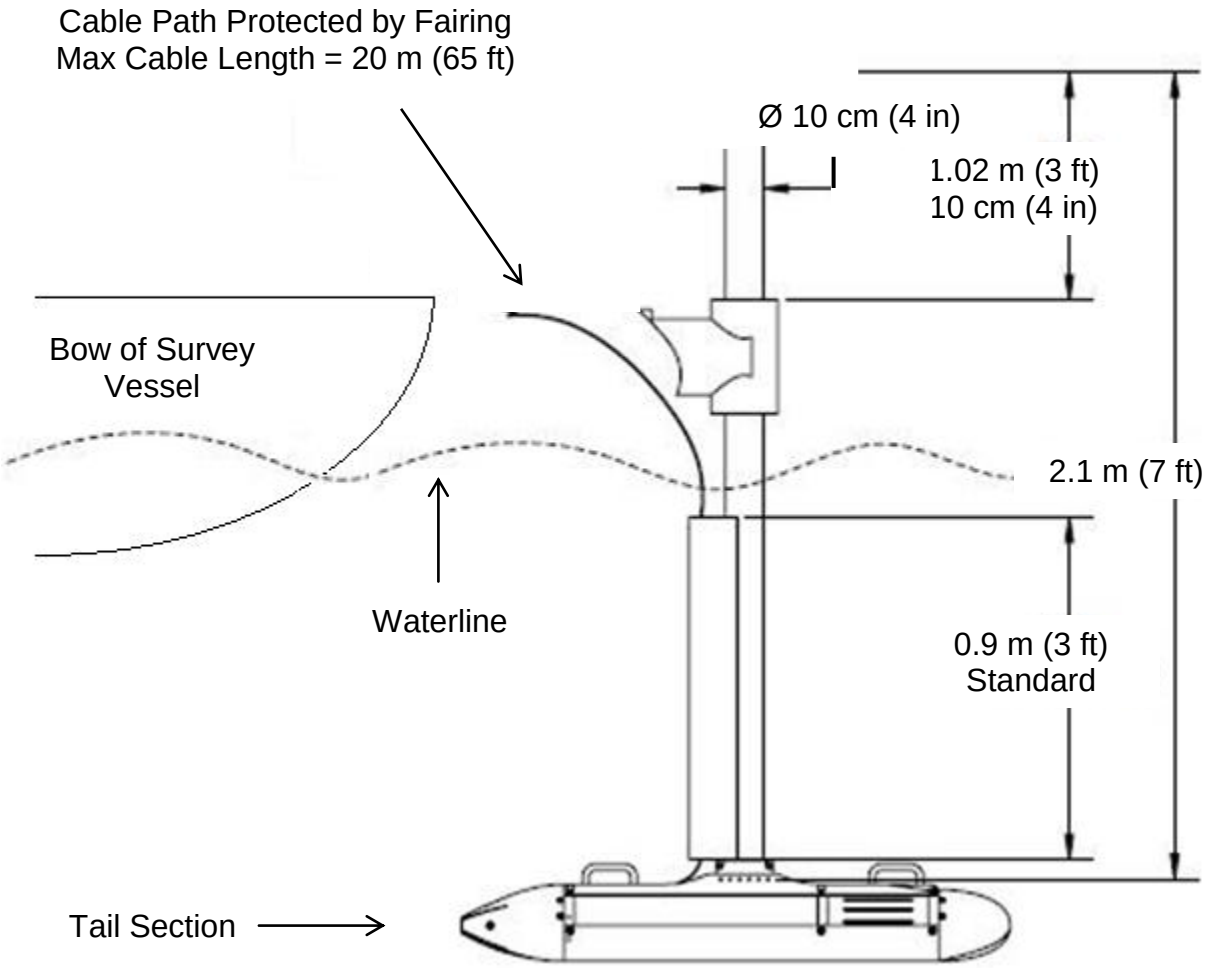


Figure 1-2: Mounting Pole Concept Drawing

1.4.2 Optional Dual Headed GPS System

Figure 1-3: Crescent VS111 Series Hemisphere GPS

1.4.3 Optional Motion Reference Unit

Figure 1-4: SMC IMU Sensor

Please contact **EdgeTech Customer Service** for further product and purchasing information.

1.5 Software Description

EdgeTech's DISCOVER 4600 Bathymetry and Side Scan Software Acquisition package provides a way to control, store, and display the bathymetry and side scan sonar data. The data is presented on a color waterfall display and is stored in JSF formats on the hard disk of the Topside Processor (see sub-section **4.2** for more information about DISCOVER 4600).

HYPACK® Hydrographic Survey Software package provides the end user with all of the necessary tools needed to design their survey, collect, process, and reduce data, as well as generate final products.

QINSy is another third party software paired with the EdgeTech 4600 system. QINSy is an integrated navigation system software package used extensively worldwide for acquiring and processing multibeam data.

NOTE: *The 4600 Topside Processing Unit comes standard with pre-installed third party software (currently the default is HYPACK), unless the customer has specified otherwise upon time of purchase.*

SECTION 2: COMPONENTS AND SPECIFICATIONS

The complete 4600 system consists of a Swath Bathymetry and Side Scan Sonar Head and a Topside Processing Unit. This section describes the two main components that make up the 4600 system and lists their specifications.

> NOTE: *All specifications are subject to change without notice.*

2.1 The 4600 Sonar Head

The 4600 Swath Bathymetry and Side Scan Sonar Head comes standard with a Sonar Processor, Port and Starboard Sonar Arrays, a Sound Velocity Sensor (SVS), a Nose and Tail Cone, and a Mounting Bracket with handles. A Mounting Pole may be purchased separately to secure the 4600 System to a survey vessel. These components are demonstrated in Figure 2-1:

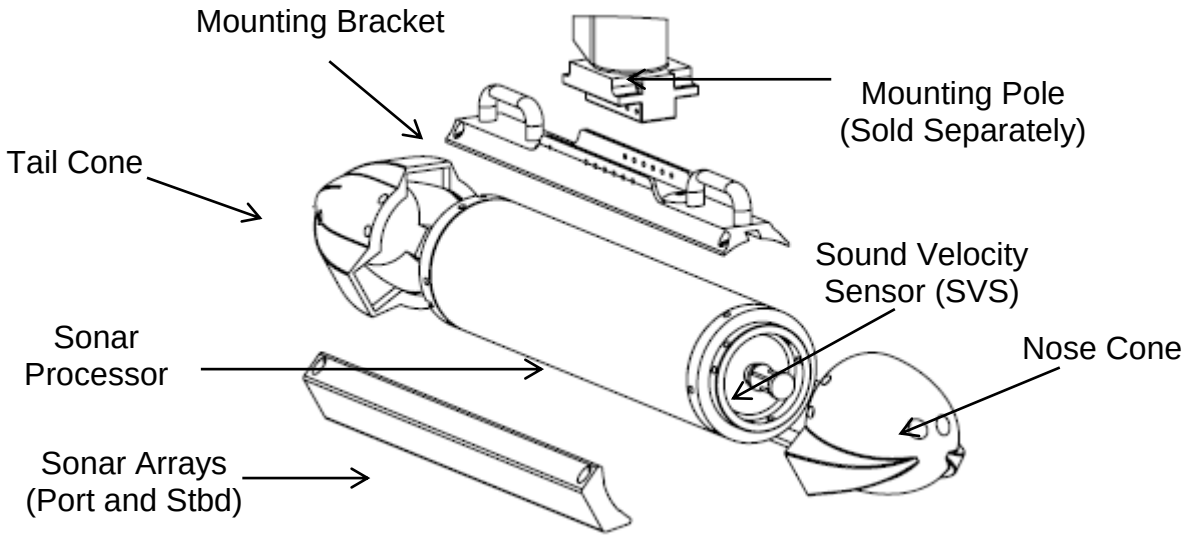


Figure 2-1: 4600 Sonar Head Components

> **NOTE:** *Please become familiar with these terms in Figure 2-1, as they will be referenced throughout the rest of this manual.*

Sub-sections **2.1.1** through **2.1.5** give a detailed description of the standard components illustrated in Figure 2-1.

2.1.1 Sonar Processor

The 4600 Sonar Processor has a built-in PC running Windows XP as its operating system. The main firmware installed on the embedded PC is an application called *sonar.exe*. This firmware controls the sonar's hardware and performs specific functions such as the signal processing and time synchronization of the acquired data.

2.1.2 Sonar Arrays

The 4600 operates at one of two frequencies (230 kHz or 540 kHz) and uses two arrays (port and starboard) to map the seafloor. Each 4600 hydrophone array is constructed using nine, independent, longitudinal PZT elements. One of these elements is used only for the transmit function, while the remaining eight elements make up an approximately half wavelength spaced array of sensors for its receiver.

The eight independent elements are connected to eight independent receive channels that are used to estimate the amplitude and phase measurements. Selected sub-elements of each array are used to form the side scan display data.

2.1.3 Sound Velocity Sensor

The 4600 Sonar Head has a flooded section in the front that is used to house an OEM version of the AML SV-X change sound velocity sensor (SVS). This sensor provides a response time of 47 µs, a resolution of 0.001 m/s, and a theoretical accuracy of ±0.025 m/s. A closer look at the SVS is presented in Figure 2-2.

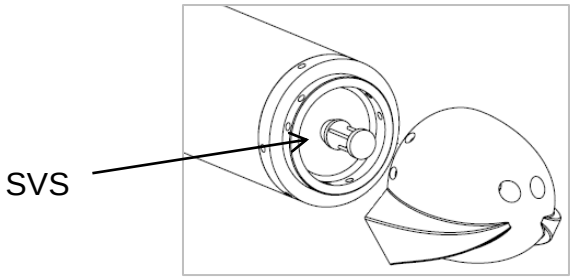


Figure 2-2: SVS in Nose of Sonar Head

2.1.4 Nose and Tail Cones

The 4600 Nose and Tail Cones supply a streamline body for efficient underwater maneuvers. The cones also serve as protection for the SVS at the front and for the array and deck cable connections at the rear.

2.1.5 Mounting Bracket

The 4600 Mounting Bracket provides the user with an efficient way to carry the system via the two handles at the front and back of the Sonar Head. It also offers a way for the user to secure the 4600 to their deployment mechanism while protecting the 20 m deck cable.

2.2 The 4600 Topside Processing Unit

The 4600 Topside Processing Unit includes a 4600 Sonar Interface and a Topside Processor (see Figure 2-3).

Figure 2-3: 4600 Topside Processing Unit

2.2.1 The 4600 Topside Sonar Interface

The 4600 Interface has two purposes:

- To provide power to the Sonar Head
- To provide a direct link between the Sonar Head, any supporting sensors, and the Topside Processor

The interface delivers power to the system and transmits/receives data via a 20 m (65 ft) Deck Cable and a 20 pin Amphenol connector. The interface also supplies two high-speed, high-accuracy (10Mbps) COM ports, along with a third COM port configured for standard connections to intake the navigation, heading, and attitude data from the supporting sensors. These connections are explained in more detail in **SECTION 3**:.

2.2.2 The Topside Processor

The 4600 Topside Processor is a high-performance PC running Windows 7 as its operating system. The Topside Processor is used to simultaneously execute EdgeTech's DISCOVER 4600 Side Scan Acquisition software and Bathymetric Processing module, as well as a third-party data acquisition and processing software. Such third-party software includes HYPACK's Hydrographic Surveying Software, QINSy's Data Acquisition, Navigation, and Processing Software, etc. The Topside Processor also has a 1 TB hard drive to store the bathymetry and side scan data.

NOTE 1: *The 4600 Topside Processing Unit comes standard with pre-installed third party software (HYPACK or QINSy) based on the customers preference, unless the customer has specified otherwise upon time of purchase.*

NOTE 2: *Although the Topside Processor may look and operate like a general purpose PC, it is not designed to have other software installed. Installing other software besides the ones supplied with the system can have undesirable effects, such as poor and/or slow performance when acquiring bathymetry and side scan data, the possibility of missing and/or incomplete data being acquired, and in the worst case, the possibility of a complete system crash..*

2.3 Deck Cable

The deck cable is a 20 meter (65 feet) underwater, high-speed network data and power cable. The deck cable includes Cat 5e 4 pair stranded conductors that meet or exceed TIA 568-B, and is suitable for 10Base-T and 100Base-T. The deck cable is also terminated with a Seacon MINK19-CCP dry mate connector on both ends, has a breaking strength of 545 kg (1200 lbs), and provides power and telemetry to the 4600 system.

2.4 Product Specifications

Table 2-1 provides a list of the specifications for the 4600 Swath Bathymetry and Side Scan Sonar system.

Table 2-1: In-depth Specifications for 4600 System

	230 kHz Model	540 kHz Model
Physicals		
Size:	1210 L x 260 W x 230 H (mm) 47.64 L x 10.13 W x 9.18 H (in)	1210 L x 260 W x 230 H (mm) 47.64 L x 10.13 W x 9.18 H (in)
Weight:	44 kg (98 lbs)	44 kg (98 lbs)
Construction:	Aluminum and Polyurethane	Aluminum and Polyurethane

	230 kHz Model	540 kHz Model
Color	Yellow and Black	Yellow and Black
Sealing	Watertight Cover O-ring Seal with Purge Valve	Watertight Cover O-ring Seal with Purge Valve
Side Scan Sonar		
Frequency	230 kHz	540 kHz
Range (per Side)	225 m (728 ft)	125 (410 ft)
Range Resolution	30 mm (1.18 in)	15 mm (0.6 in)
Beam Width Along Track	0.64° (2-way)	0.5° (2-way)
Depression Angle	30°	30°
Interferometric Swath Bathymetry		
Maximum Swath	350 m	150 m
Range Resolution	60 mm (2.36 in)	30 mm (1.18 in)
Ping Reception Rate	25 m (82 ft) = 30 Hz, 50 m (164 ft) = 15 Hz, 100 m (328 ft) = 7.5 Hz	25 m (82 ft) = 60 Hz, 50 m (164 ft) = 30 Hz, 100 m (328 ft) = 15 Hz
Max Depth Below Tx	120 m	50 m
Sonar Head Power Requirements		
DC Input	48 VDC	48 VDC
Power	100 Watts	100 Watts
Environment		
Operating Temperature:	0°C to 40°C (32°F to 104°F)	0°C to 40°C (32°F to 104°F)
Storage temperature:	-20°C to 60°C (-4°F to 140°F)	-20°C to 60°C (-4°F to 140°F)
Operating relative humidity:	0 to 80%	0 to 80%
Non-operating storage relative humidity:	0 to 100%	0 to 100%
Topside Interface		
Interface	100 baseT Ethernet Serial RS-232	100 baseT Ethernet Serial RS-232
Power Supply	110/220 VAC Auto-Sensing	110/220 VAC Auto-Sensing
Topside Processor		
Operating System	Windows 7	Windows 7

	230 kHz Model	540 kHz Model
Interface	100 baseT Ethernet, 100 baseT Ethernet Serial RS-232	100 baseT Ethernet, 100 baseT Ethernet Serial RS-232
Display	Dual 21" LCD Monitors, Dual 21" LCD Monitors, Expandable to 4	Dual 21" LCD Monitors, Dual 21" LCD Monitors, Expandable to 4
Storage	1TB min Hard Drive & RW-DVD	1TB min Hard Drive & RW-DVD
Power Supply	110/220 VAC Auto-Sensing	110/220 VAC Auto-Sensing

2.5 Data Formats and Connections

In order to collect valid survey data, the following is required to support the survey operations and correct processing of the 4600 Bathymetry and Side Scan echo data:

i. GPS Position or Latitude and Longitude in NMEA format,

ii. Heading data in NMEA format or EM1000 binary format

iii. Attitude or Roll, Pitch and Heave data in TSS1 or EM1000 binary format

iv. Time sync data in NMEA format

These data may be supplied by 1, 2, or 3 individual sources.

1. Position Data – this may be supplied via any of the following NMEA type sentences/messages:

   - $xxGGK ** (Applanix PosMV Format)
   - $xxGGA
   - $xxGLL
   - $xxRMC
   - $PTNL, GGK, … ** (Trimble Format)

   ** = Non-NMEA standard sentences

2. Heading Data – this maybe input via:

   - NMEA, $xxHDT sentence, or

- EM1000 binary format along with attitude data

3. Attitude (Roll, Pitch, and Heave) Data – this may be input via:
   - EM1000 binary format, or
   - TSS1 format
4. Time Input - supported sentences are in order of (priority/use)
   - $xxZDA
   - $xxGGK (derived from data in item a. above)
   - $xxGGA
   - $xxRMC
   - $xxGLL

At minimum, items 1, 2, and 3. above are required and must be supplied.

2.6 System Connections and Data Flow

The following sections describe the Ethernet LAN Connections, COM Ports, Hardware Data Flow, and Sonar Data Flow for the 4600 system.

2.6.1 Ethernet LAN Connections

The Ethernet LAN connection from the Sonar Head to the 4600 Topside Interface is made using a physical wired connection via the standard 20 m deck cable. This cable is fixed to the Sonar Head and provides a Seacon 19 pin connector for direct connection from the Sonar Head to the 4600 Sonar Interface. The 4600 Sonar Interface then connects to the Topside Processor via a standard RJ-45 Ethernet plug. The Topside Processor automatically senses straight and crossover Ethernet cables.

2.6.2 COM Ports

There are three COM ports provided on the 4600 Sonar Interface. COM1 and COM2 have been configured for high speed and high accuracy (10Mbps). COM3 is configured for standard connections. These COM ports are provided to intake the navigation, heading, and attitude (roll, pitch, and heave) data from the supporting sensors. (Please see **APPENDIX A**: on how to configure the COM ports).

2.6.3 Hardware Data Flow

Figure 2-4 is a block diagram that illustrates the interconnections between the 4600 Swath Bathymetry and Side Scan Sonar System, the 4600 Topside System, and all supporting sensors.

A more detailed block diagram demonstrating the interconnections and inputs to the 4600 Sonar Interface is shown in Figure 2-5. This illustration also gives three examples of possible sensor configurations.

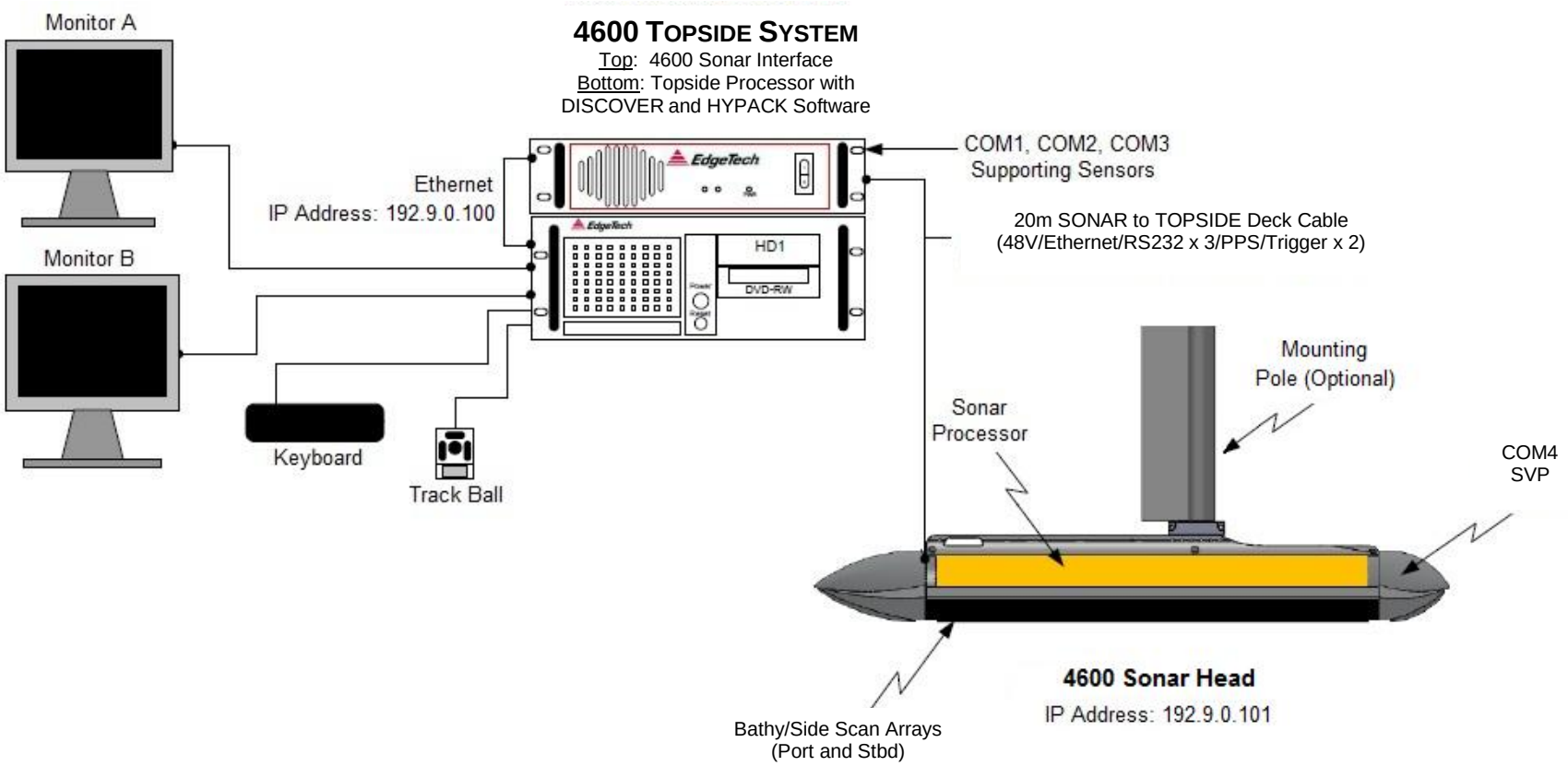


Figure 2-4: Hardware Data Flow Diagram

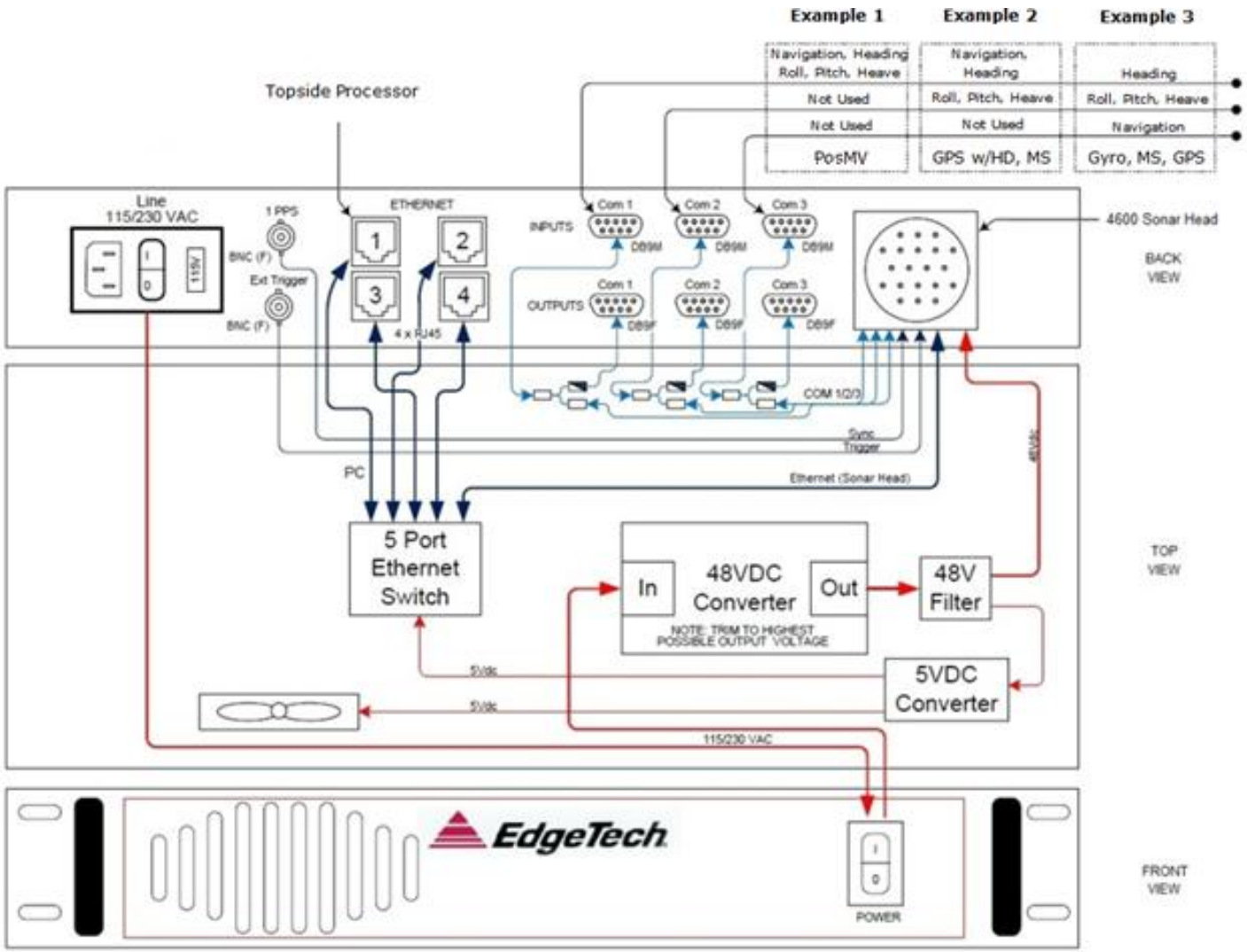


Figure 2-5: **Sonar Interface Box Connections**

In Figure 2-4, the 4600 Sonar Interface connects to the Sonar Head via the Seacon 19 pin connector and Deck Cable. Navigation, heading, roll, pitch, and heave data from the supporting sensors via COM ports 1, 2, and/or 3, are inputted at the Sonar Interface, passed through the Deck Cable, and logged by the Sonar Processor in the Sonar Head.

These data are then transmitted, along with the raw side scan data, with a common timestamp up the deck cable to the 4600 Sonar Interface, and passed to the Topside Processor through the Deck Cable and via Ethernet Port 1 (IP Address: 192.9.0.100). The Topside Processor then processes these data using the DISCOVER and Bathymetry software to send amplitude, angle and range data to the third party software for logging and post processing. This process is explained in further details in the following section. The third party and DISCOVER Side Scan/Bathymetry processors all run on the same computer.

The first example in Figure 2-6 depicts an Applanix PosMV system interfacing to the 4600 Sonar Interface. This type of system provides navigation (latitude/longitude), heading, roll, pitch, and heave data and so no other sensor is required. The PosMV should be connected to COM1 or COM2.

The second example shows the most common interfacing scenario, a GPS that provides navigation and heading data, accompanied by a motion sensor for attitude measurements. The COM ports should be assigned as such:

COM1 = GPS (Navigation and Heading)
COM2 = MRU (Roll, Pitch, Heave)

These assignments may be interchanged between COM1 and COM2 because both ports have been configured for high speed and high accuracy. COM3 should not be used in this scenario.

The third and last example portrays the situation where the supplied GPS does not provide heading data. In this case, three sensors are required – a GPS for navigation (latitude/longitude), a Gyro for heading, and a motion sensor for roll, pitch, and heave measurements. Therefore, all three COM ports should be used and assigned as follows:

COM1 = Gyro (Heading)
COM2 = MRU (Roll, Pitch, Heave)
COM3 = GPS (latitude/longitude)

The sensors allocated to COM1 and COM2 may be interchanged because of the same reason stated above in the second example. The GPS data, or latitude and longitude data,

must be allotted to COM3 because it does not rely on the high accuracy time stamp as the first two measurements.

> **NOTE:** *To configure the COM ports according to the examples given above, please see* ***Error! Reference source not found.****.*

2.6.4 Sonar Data Flow

To illustrate the data flow between DISCOVER, the Bathymetry Processor, and the third party software, the block diagram in Figure 2-6 is used. Hypack is the default and will be used as an example in the following exercise.

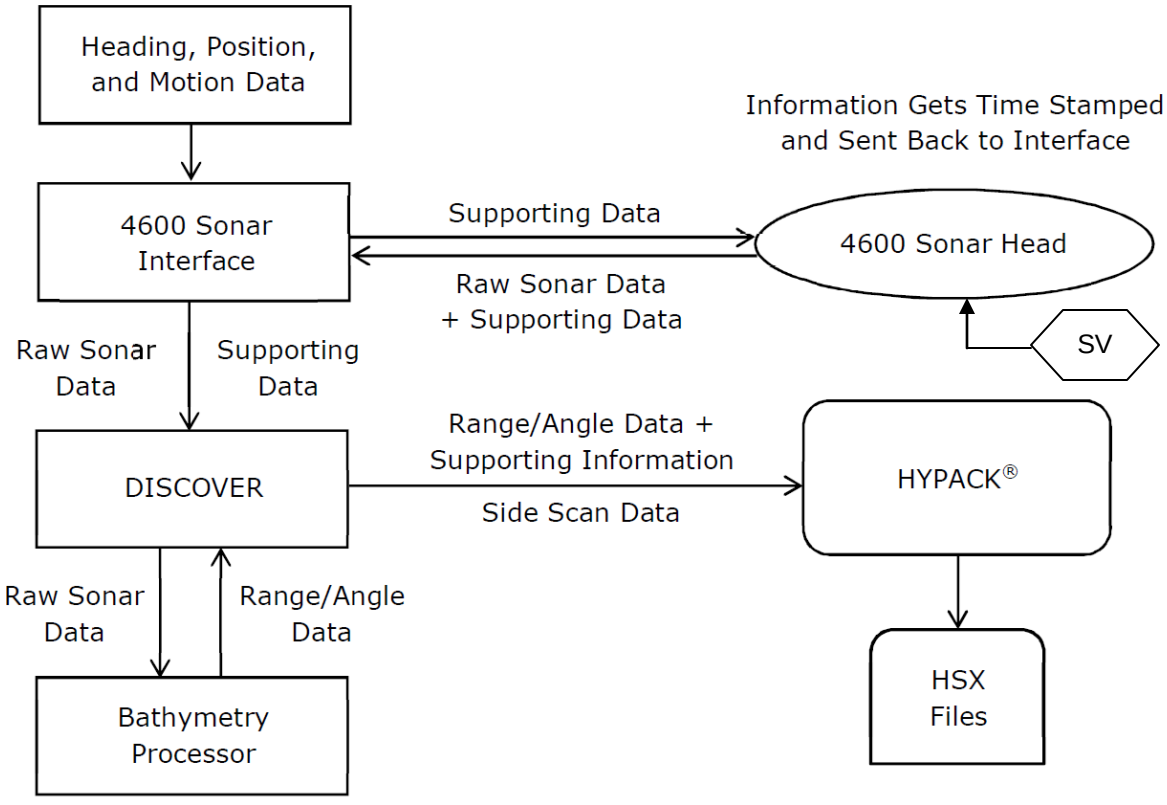


Figure 2-6: Sonar Data Flow

As demonstrated by the flow chart, the 4600 Sonar Interface acquires the heading, position (latitude/longitude), and motion (roll, pitch, and heave) data and relays this information to the 4600 Sonar Head via the Deck Cable. Here, the information is combined with the raw sonar and sound velocity data, time stamped with a common value, and sent back to the 4600 Sonar Interface. DISCOVER intakes the raw sonar data and sends it to the Bathymetry Processor, where the raw data is converted to range and angle data. The Bathymetry Processor transmits this range/angle data back to DISCOVER, where it is then displayed on the monitor, packaged with the heading, position, motion, and side scan data, and recorded as a *.JSF file.

This complete data package is then sent to and used by the third party software (in this case HYPACK®) to generate three-dimensional bathymetry data files and to display side scan and bathymetry data on a monitor. Finally, these three-dimensional bathymetry data files can be used post survey to generate hydrographic final products.

SECTION 3: SET-UP AND DEPLOYMENT

Assembly and installation of the EdgeTech 4600 Swath Bathymetry and Side Scan Sonar System encompasses unpacking, inspecting, and connecting the system's components, connecting the supporting sensors, and verifying that the system operates correctly using EdgeTech's DISCOVER 4600 and third party software. This section provides instructions on how to perform these tasks.

3.1 Unpacking and Inspecting

The Sonar Head, Topside Processing Unit, and supporting sensors are shipped in separate, reusable, heavy duty transport cases. The necessary cables, spares kit, and documentation are also included.

Before unpacking the system's components, inspect the shipping containers for any damage. If any damage is noticed, please report it to the carrier and to EdgeTech immediately. If the shipping containers appear damage free, carefully unpack the components and inspect them.

Also, please check the packing list and verify that all the items on the list are included. Again, if any damage is found, please report it to the carrier and to EdgeTech immediately. If any items are missing, please contact **EdgeTech Customer Service**. Do not install or operate any equipment that appears to be damaged.

Although the items shipped may vary, depending on the customer's requirements, the standard components for the 4600 Swath Bathymetry and Side Scan Sonar system are listed in sub-section **1.3** on page 1-2.

3.2 Sonar Head Assembly

The 4600 streamline body system includes the Sonar Processor, two Hydrophone Arrays (one Port and one Starboard), a Nose and Tail Cone, a Mounting Bracket with handles, a Sound Velocity Sensor (located in the Nose section of the Sonar Head and is described in sub-section **2.1.3** on page 2-2), and a 20 m Deck Cable.

NOTE: *The 4600 Sonar Head is sent to the customer pre-assembled. If for some reason, the customer has disassembled the system, please use this set of instructions to reassemble the Sonar Head. EdgeTech does not recommend anyone, other than trained EdgeTech engineers, to assemble and/or disassemble the 4600 system.*

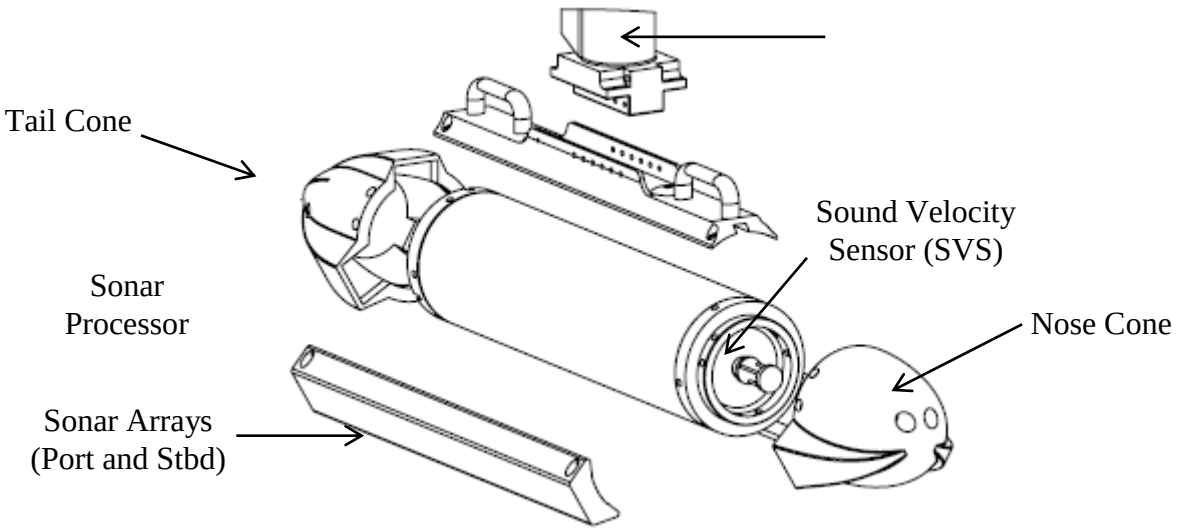


Figure 3-1: Sonar Head Components (Deck Cable Not Shown)

To assemble the 4600 Sonar Head:

1. Secure the Nose Cone to the front of the Sonar Processor using six 3/8 – 16 x ¾ inch socket cap screws and a 5/16 inch Allen wrench. The front of the system can be identified by the section of the cylindrical body that houses the SVS (Figure 3-1).
2. Attach the Port Array to the port side of the Sonar Processor using six 3/8 – 16 x ¾ inch button socket cap screws, six 3/8 inch split lock washers, and a 7/32 inch Allen wrench. Ensure the connectors are facing the tail section (opposite of the SVS section). The Port and Starboard Arrays are unique and must be put back exactly as they were assembled. Usually the arrays have a label on the back side stating which array goes where.
3. Attach the Starboard Array in the same manner as in Step 2.

4. Connect the Port and Starboard Arrays to the Sonar Processor as in Figure 3-2; where J2 mates to the starboard array's transmitter via the Subconn 5 pin male connector (MCIL5M-P), J3 couples to the starboard array's receivers via the Seacon 19 pin female connector (MINK19-CCP), J5 connects to the port array's transmitter via the Subconn 5 pin male connector (MCIL5M-P), and lastly J6 couples to the port array's receivers via the Seacon 19 pin female connector (MINK19-CCP).

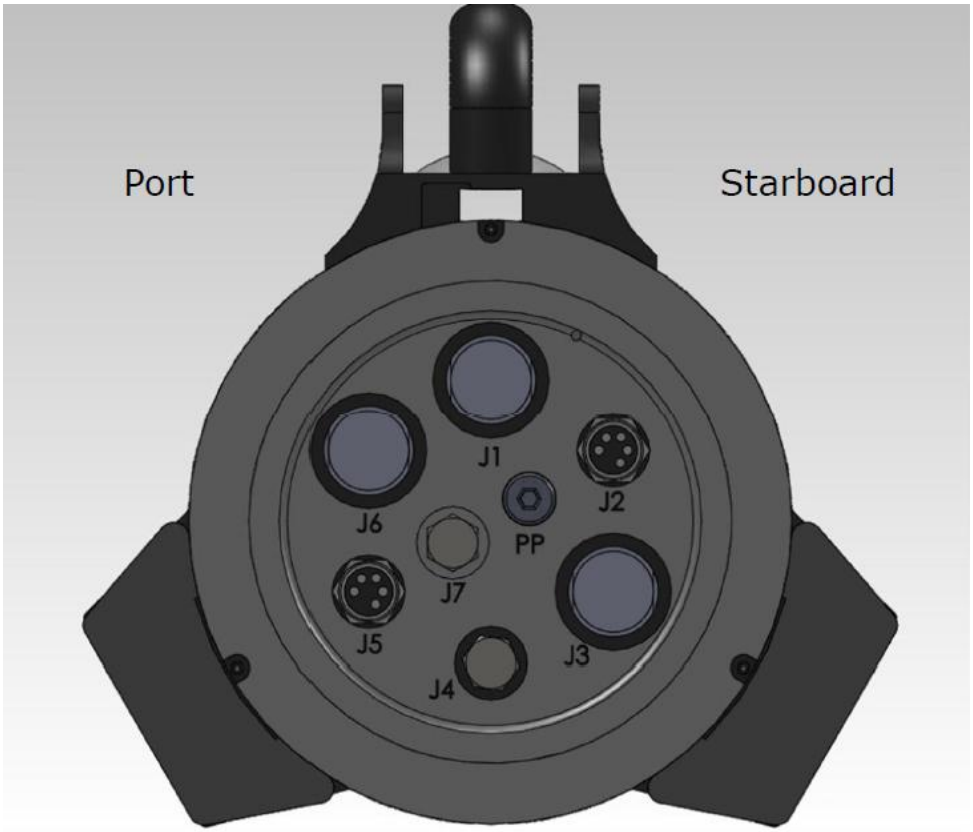


Figure 3-2: Sonar Processor Connections on End Cap

5. Orient the Mounting Bracket on top of the Sonar Processor so that the longest part of the keyway is pointing towards the tail section as shown in Figure 3-3.

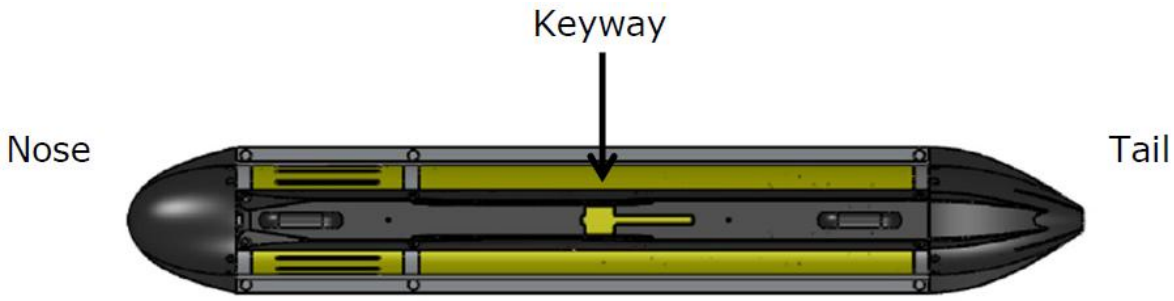


Figure 3-3: Top View of Mounting Bracket on Sonar Head

6. Lift the Mounting Bracket and feed the tail end of the 20 m Deck Cable through the provided keyway (Figure 3-4). The tail end of the Deck Cable has the Seacon 19 pin female connector (MINK19-CCP).

7. Ensure the Deck Cable stays within the slotted region of the keyway on the Mounting Bracket and pull the cable towards the tail section (Figure 3-4).

8. Connect the Deck Cable to the Sonar Processor using the Seacon 16 pin female connector (MINK16-CCP) to J1, as indicated in Figure 3-2 and Figure 3-4.

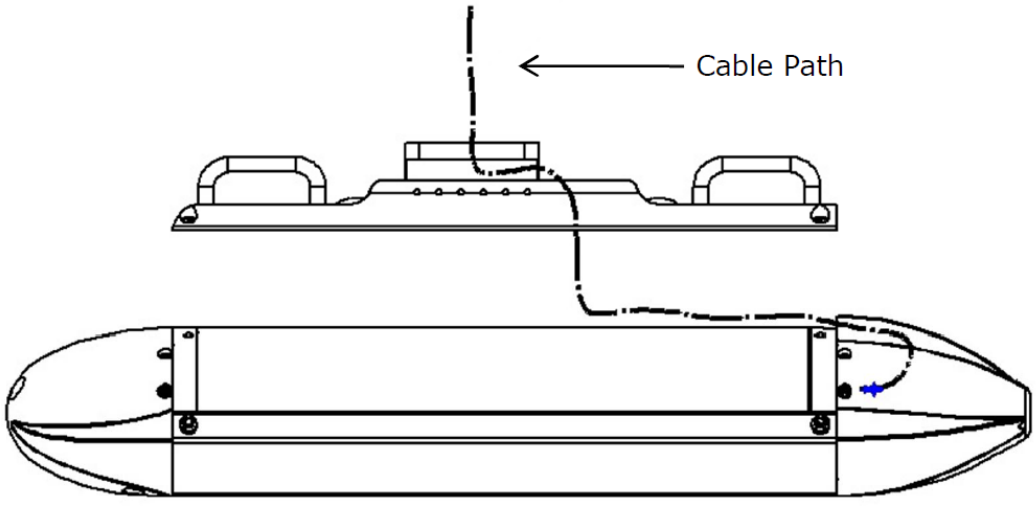


Figure 3-4: Connecting the Deck Cable to End Cap

9. Secure the Mounting Bracket to the top of the Sonar Processor using four 3/8 – 16 x ¾ inch button socket cap screws, four 3/8 inch split lock washers, and a 7/32 inch Allen wrench.

10. Attach the Tail Cone to the tail section of the Sonar Processor using six 3/8 – 16 x ¾ inch socket cap screws and a 5/16 inch Allen wrench.

– Assembly Complete –

3.3 Sonar Head Installation

The 4600 System's installation on the survey vessel is the customer's responsibility, and certain considerations need to be kept in mind. The Sonar Head can be mounted on the side of a vessel, but it is recommended to secure the 4600 to the bow of the boat. Consideration must be given to keel clearance for both cases. This section outlines the 4600 Sonar Head deployment options.

> **NOTE:** *If interested in purchasing the optional mounting pole for the 4600 installation, please contact **EdgeTech Customer Service**.*

3.3.1 Over-the-Bow Deployment

The first and recommended option is to mount the 4600 Sonar Head to the bow of the survey vessel. An example of an over-the-bow deployment is depicted in the photographs in Figure 3-5. If help is needed with this type of installation, please do not hesitate to contact **EdgeTech Customer Service**.

3.3.2 Over-the-Side Deployment

An alternative to the latter is to mount the 4600 Sonar Head over the side of the survey vessel. An example of an over-the-side deployment is illustrated in the images in **Error! Reference source not found.** If help is needed with this type of installation, please do not hesitate to contact **EdgeTech Customer Service**.

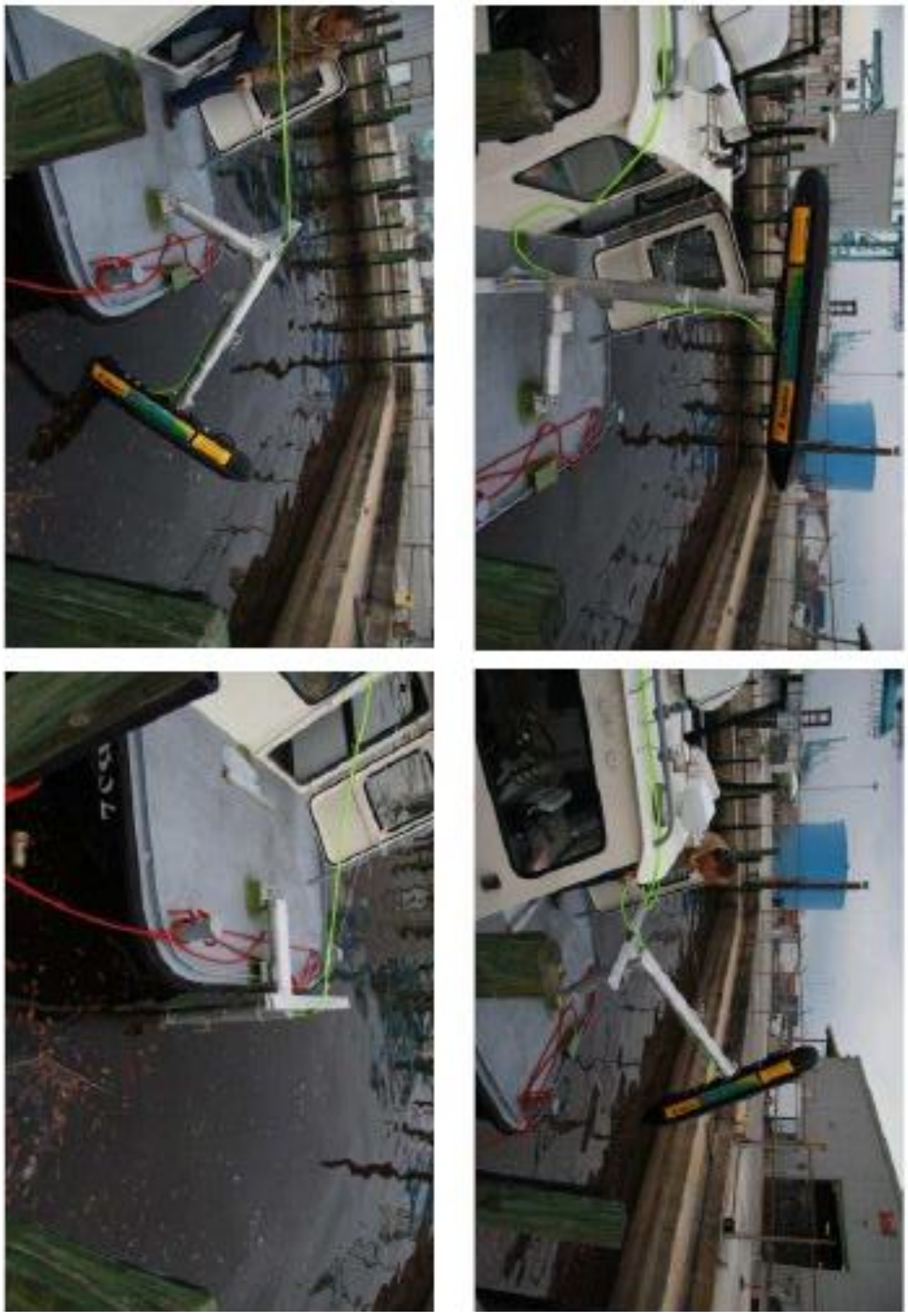


Figure 3-5: 4600 Deployment, Option 1: Over-the-Bow

Figure 3-6: 4600 Deployment, Option 2: Over-the-Side

3.4 Positioning the Topside Processing Unit

The Topside Processing Unit should be located and set up in a dry, sheltered area on the survey vessel that is protected from weather and water spray. The temperature should also consistently be between 0°C and 40°C (32°F and 104°F). Avoid areas of direct sunlight, especially in tropical environments, as heat build-up can occur and viewing the LCD monitor and status indicators can become difficult.

The location should also enable direct communications with the deck crew that is operating the survey vessel, Sonar Head, and other supporting sensors. Secure the Topside Processing Unit in place near the required power source.

3.5 Topside Connections

After the Sonar Head has been installed, and the Topside Processing Unit correctly placed on the survey vessel, the supporting sensors can now be connected. This section describes how to interconnect the supporting sensors, Sonar Head and Topside Processing Unit.

1. Connect the provided two HP monitors to the back of the Topside Processor via the DVI connectors.
2. Position the monitors on the vessel accordingly and power them ON.
3. Connect the keyboard and mouse via the USB ports on the back of the Topside Processor.
4. Turn ON the Topside Processor via the power switch on the front of the Topside Processing Unit.

> **NOTE:** *If the Topside Processor does not turn ON, check to see if the switch next to the PC's power cable (on the back of the Topside Unit) is in the ON position. If not, please flip the switch to the ON position.*

5. Position and secure a MRU to the vessel's center of motion. If the mounting pole was purchased from EdgeTech, an alternative way to attach the MRU is to the top of this mounting pole.

6. Measure the location of the Sonar Head relative to the MRU. If the MRU was attached to the Sonar Head's mounting pole, measure the relative location of the MRU to the vessel's center of motion.

> **NOTE:** *These measurements are important and will be used later as Offsets in the third party acquisition and post processing software. So please make sure to measure and note the exact location of the MRU to the vessel's center of motion.*

7. Setup the GPS as described in the GPS's user manual.

8. Measure the location of the GPS's antenna relative to the vessel's center of motion. If a dual antenna GPS system is used, please measure from the midpoint of the two antennas to the vessel's center of motion.

9. If your GPS does not provide heading, install a Gyro as described by the Gyro's user manual and measure it's offsets relative the vessel's center of motion.

10. Connect the Sonar Head to the 4600 Topside Interface via the Seacon 19 pin connector.

11. Connect the MRU to COM1 and the GPS to COM2. If a dual antenna GPS system was not used and a Gyro was required to provide heading, then please connect the Gyro to COM2 and the GPS to COM3.

    - A MRU is used to measure the pitch, roll, and heave of the survey vessel.
    - A GPS is used to gather position (latitude/longitude) data and may or may not provide heading.

> **NOTE 1:** *Please refer to sub-section **2.6.2** on page 2-8 for more information on connecting the COM Ports. Also, please use Appendix A to configure the COM ports for the individual sensors.*

> **NOTE 2:** *Please refer to sub-section **2.5** on page 2-7 to ensure the correct data formats are used for each sensor.*

3.6 Care and Maintenance

The 4600 System was not designed for long term deployments and it is not recommended to keep the system in water for more than two weeks. After each mission, the system should be rinsed thoroughly with freshwater, making sure to rinse the SVS at the front and connectors at the back using the provided rinse holes in the nose and tail cones.

Inspect the face of the arrays after every deployment for organism growth or damage. If any residue is noticed, clean the array faces using a wash cloth with mild soap and water. If any damage is observed, contact **EdgeTech Customer Service** immediately.

In addition, the SVS sensor should be inspected regularly. If fouling is observed on the sensor, carefully clean it based on the manufacturer's recommendations. The sensor does not need regular calibration, but it is suggested to have it calibrated at least once every two years.

SECTION 4: PRINCIPLES OF OPERATION

This section describes how to operate the 4600 system in order to collect data with DISCOVER and your third party topside interface.

4.1 Confirming Supporting Data is Present

To ensure the Sonar Head's processing unit is communicating properly with the Topside Processor, follow these steps.

1. On the Desktop, launch **Shortcut to sonar.exe**. The following window should appear.

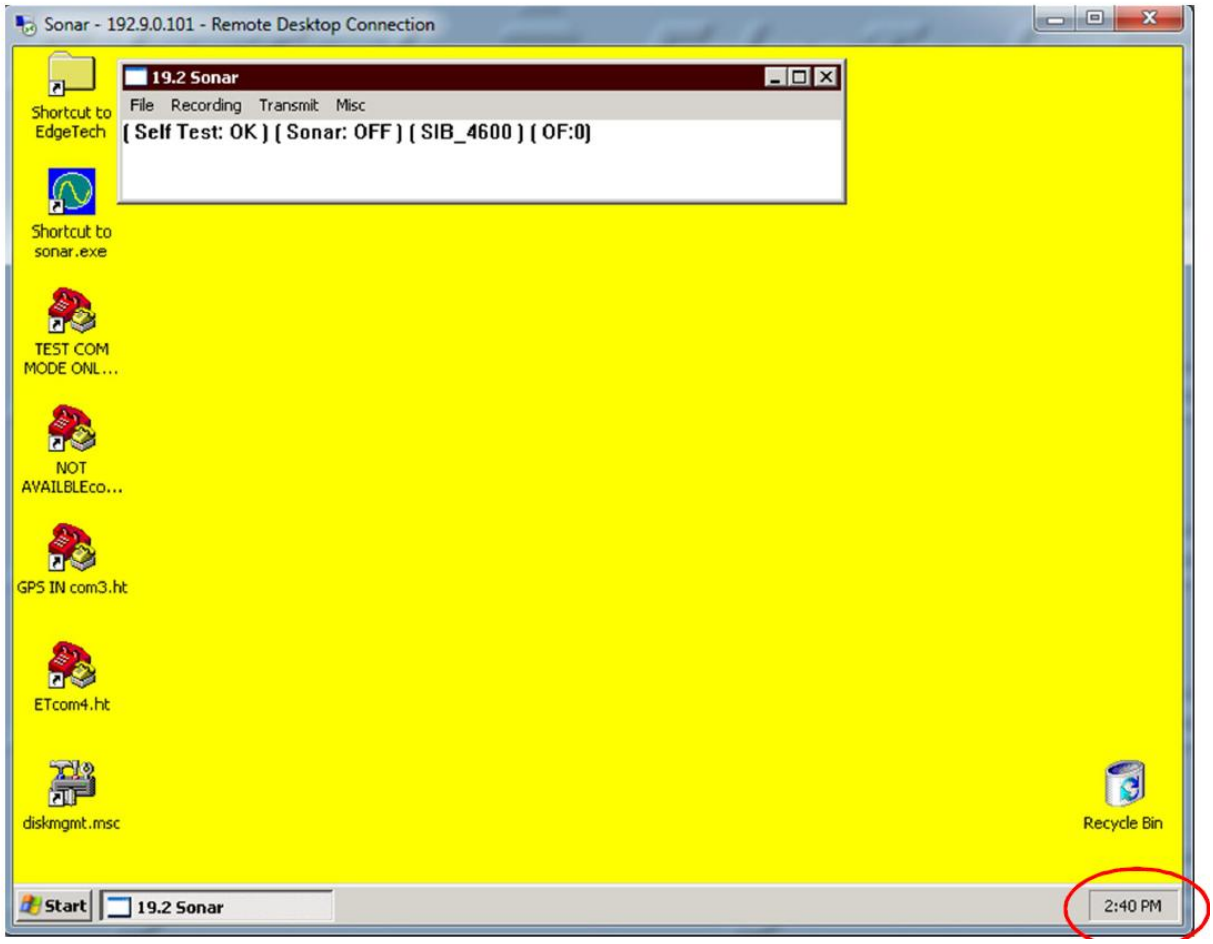


Figure 4-1: Sonar 192.9.0.101 Remote Desktop Connection Window

2. Click on Menu > Misc > Serial Port Information

3. Check each COM port in the drop down menu to ensure data is coming through for each device and in the correct format (Figure 4-1: Sonar 192.9.0.101 Remote Desktop Connection Window Figure 4-2).

   - COM1 = MRU
   - COM2 = GPS
   - COM4 = Sound Velocity Sensor in the nose of the Sonar Head

> **NOTE 1:** *COM3 would be necessary if the GPS did not provide the heading.*
>
> **NOTE 2:** *The GPS and MRU are interchangeable on COM1 and COM2 as long as the appropriate baud rate is set in the drop down menu next to the channel assignment in the Serial Port Information Window (Figure 4-2, red arrow). More information on how to configure the COM ports is presented in APPENDIX A:*.

If all systems are working properly, close this window and proceed to Step 4. If there is an issue with one of the ports, please contact **EdgeTech Customer Service**.

4. Now click on Menu > File > Show Status. The System Status window will appear as shown in Figure 4-3.

5. On the right hand side of the window, click on the Config bullet under the Update button and then on the drop down menu named Config Item.

6. Select Serial and then click the Update button several times.

7. Check to make sure all sensors' usage percentages are well below 80%. If they are not; increase the baud rates of the sensors until these percentages drop. Make sure to change the baud rate accordingly in Sonar.

8. When satisfied with the incoming data, press OK in the System Status window and then minimize the Sonar – 192.9.0.101 – Remote Desktop Connection window.

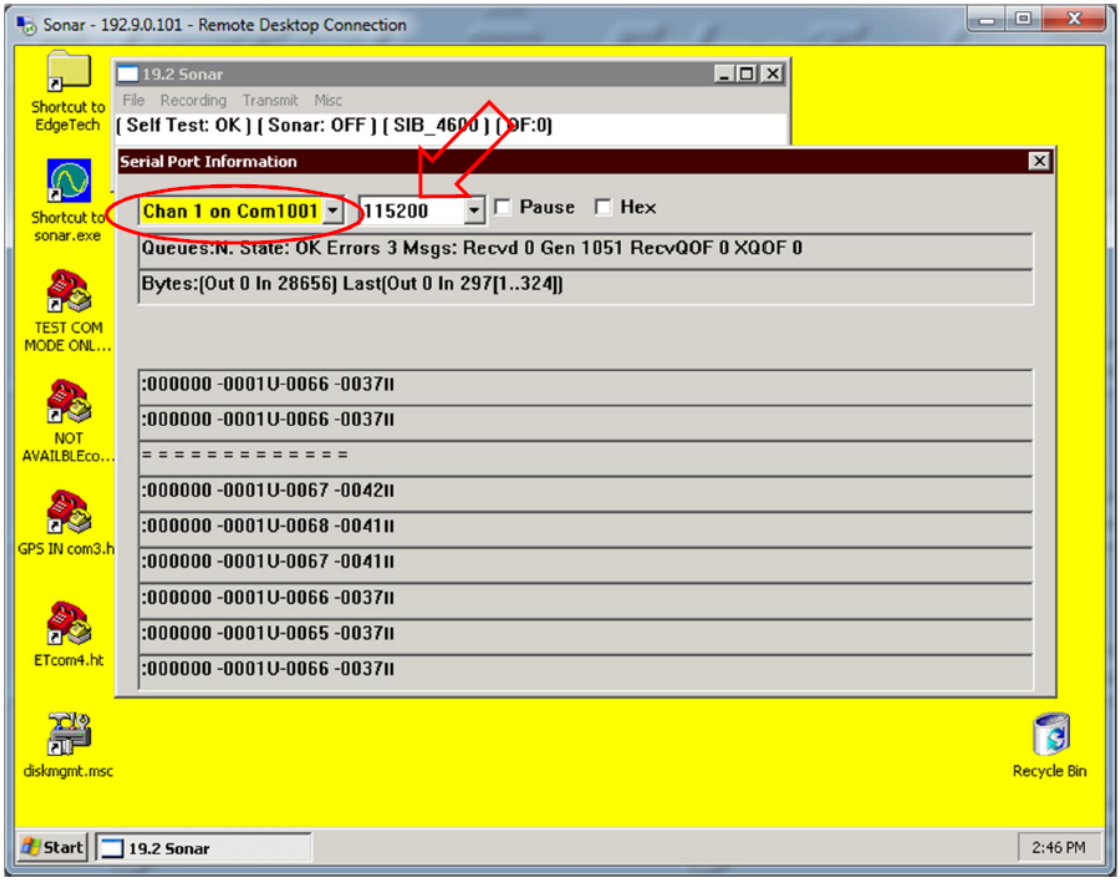


Figure 4-2: Serial Port Information Window

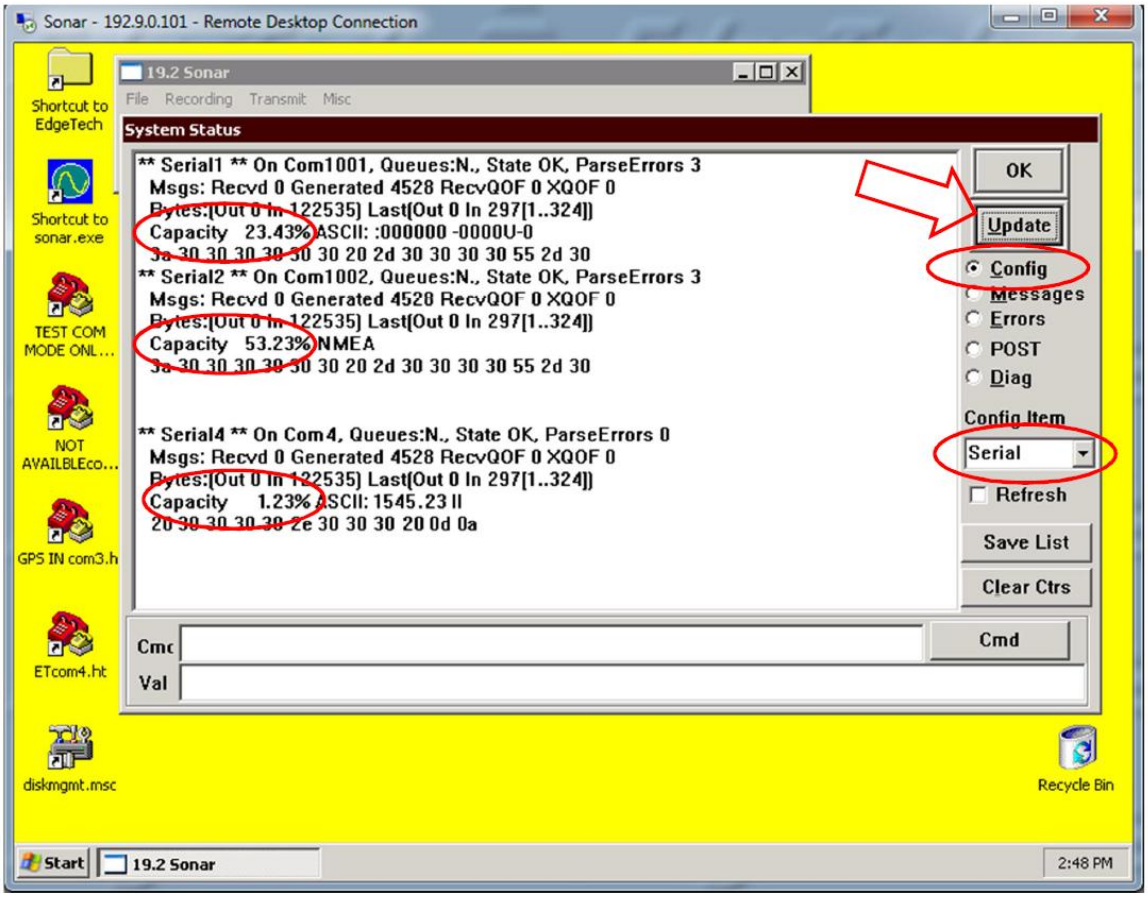


Figure 4-3: System Status Window

4.2 DISCOVER 4600

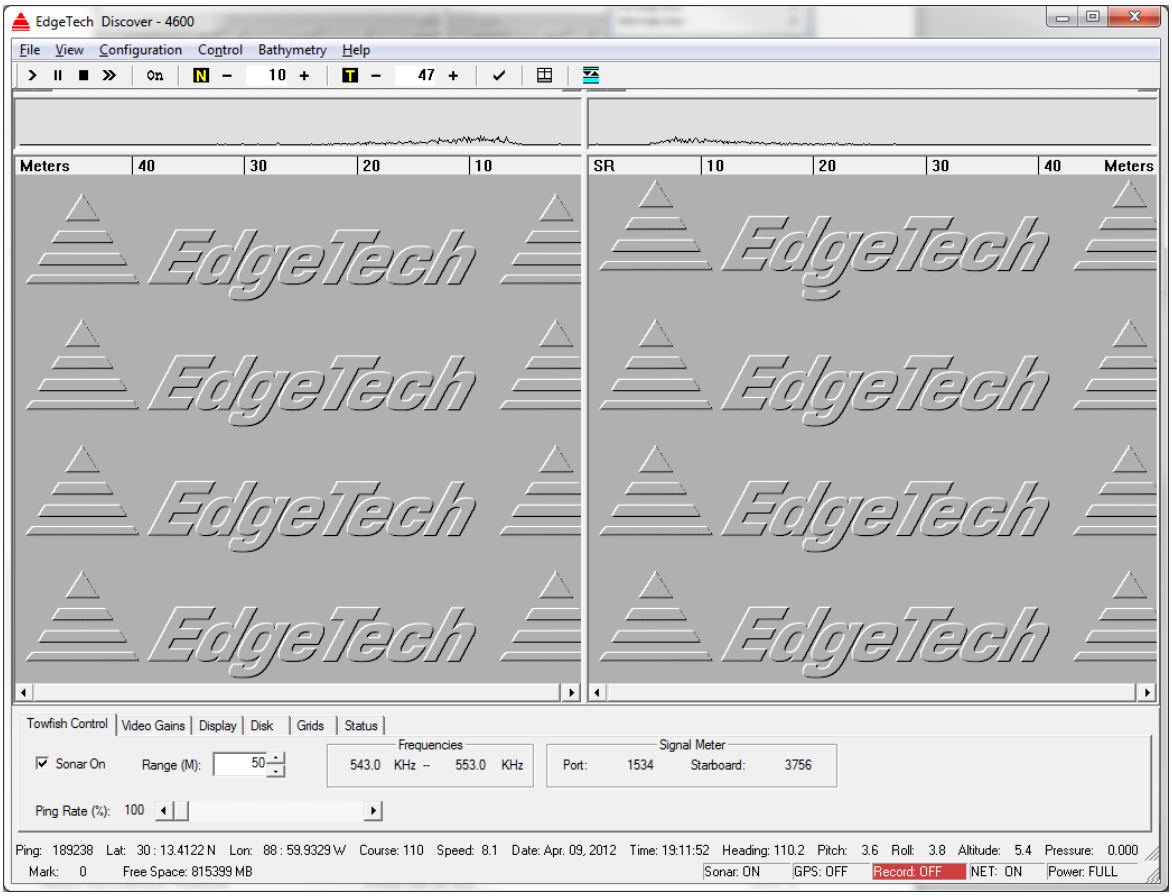
EdgeTech's DISCOVER display and control application allows recording of side scan and range/angle bathymetry data in the binary EdgeTech JSF file format. The JSF file format has been in use for 10+ years and has new public extensions to support the additional bathymetry data messages.

This section describes DISCOVER and the BATHYMETRIC PROCESSOR entirely and how to operate them during a survey.

1. Launch DISCOVER 4600 using the Desktop shortcut. The two main windows will appear as in Figure 4-4.

A -

B -


EdgeTech Discover - 4600
File View Configuration Control Bathymetry Help
On
N – 10 +
T – 47 +
Meters 40 30 20 10
SR 10 20 30 40 Meters
EdgeTech
Towfish Control | Video Gains | Display | Disk | Grids | Status
Sonar On
Range (M): 50
Frequencies
543.0 KHz – 553.0 KHz
Signal Meter
Port: 1534 Starboard: 3756
Ping Rate (%): 100
Ping: 189238 Lat: 30 : 13.4122 N Lon: 88 : 59.9329 W Course: 110 Speed: 8.1 Date: Apr. 09, 2012 Time: 19:11:52 Heading: 110.2 Pitch: 3.6 Roll: 3.8 Altitude: 5.4 Pressure: 0.000
Mark: 0 Free Space: 815399 MB
Sonar: ON GPS: OFF Record: OFF NET: ON Power: FULL

C -

Figure 4-4: DISCOVER Main Window and BATHYMETRIC PROCESSOR

The DISCOVER Main Window contains a Top Menu[A], a Toolbar Menu[B], and a Control Menu[C]. These menus are illustrated in Figure 4-4 and correspond to A, B, and C, respectively. A brief description of the shortcut keys in the DISCOVER Toolbar Menu and the DISCOVER Control Menu are given in sub-section section **4.2.1** .

The BATHYMETRIC PROCESSOR is the built in module that is responsible for computing the seafloor solutions. It displays the number of processed pings, the last altitude found by the BATHYMETRIC PROCESSOR and the number of angle sets used in the seafloor calculations.

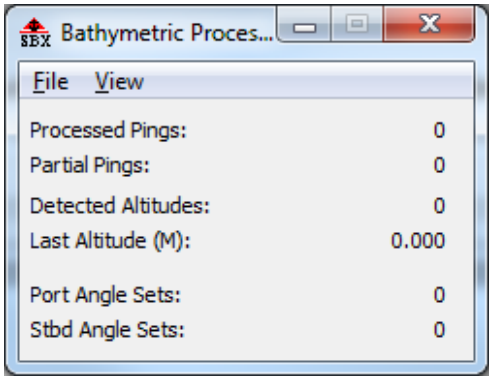


Figure 4-5: Bathymetric Processor Module

NOTE: *The BATHYMETRIC PROCESSOR will restart if you press the "x" up at the top right corner. In doing so, the BATHYMETRIC PROCESSOR will delete all current settings and revert back to its default configuration. Please refrain from pressing the "x" on the BATHYMETRIC PROCESSOR window.*

2. If the EdgeTech 4600 is powered on and connected to the 4600 Topside Interface box, then ensure that the Sonar Head is connected to DISCOVER by ensuring the network is on (**NET: ON**) down in the right hand corner of the DISCOVER main window (as pointed to by the blue arrow in Figure 4-6).

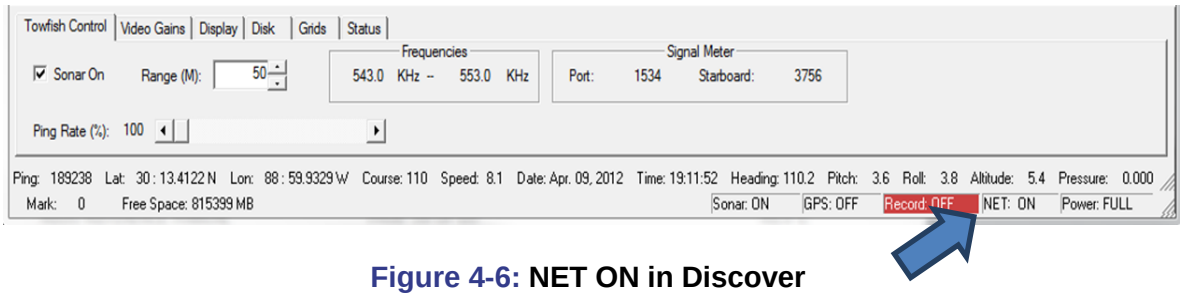

Towfish Control
Video Gains
Display
Disk
Grids
Status
Sonar On
Range (M): 50
Frequencies
543.0 KHz -- 553.0 KHz
Signal Meter
Port: 1534 Starboard: 3756
Ping Rate (%): 100
Ping: 189238 Lat: 30 : 13.4122 N Lon: 88 : 59.9329 W Course: 110 Speed: 8.1 Date: Apr. 09, 2012 Time: 19:11:52 Heading: 110.2 Pitch: 3.6 Roll: 3.8 Altitude: 5.4 Pressure: 0.000
Mark: 0 Free Space: 815399 MB
Sonar: ON GPS: OFF Record: OFF NET: ON Power: FULL

Figure 4-6: NET ON in Discover

4.2.1 DISCOVER Toolbar Menu

The DISCOVER Toolbar Menu permits the user to have easy access to certain features in the Top Menu and Control Menu. The Toolbar Menu (list B in Figure 4-4) is demonstrated in Figure 4-7 with an explanation for each.

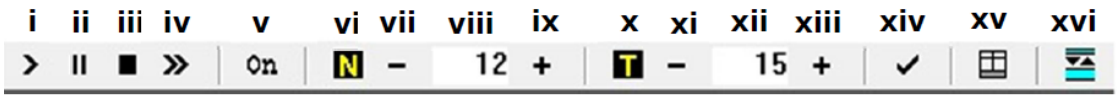


Figure 4-7: DISCOVER Toolbar Menu

i. Playback – Replays a previously collected side scan file. This feature can also be accessed under the DISCOVER Control Menu on the Disk Tab.

ii. Pause Playback – Pauses a previously collected side scan file. This feature can also be found under the DISCOVER Control Menu on the Disk Tab.

iii. Stop Playback – Stops a previously collected side scan file. This feature can also be found under the DISCOVER Control Menu on the Disk Tab.

iv. Fast Forward – Fast forwards a previously collected side scan file. This feature can also be found under the DISCOVER Control Menu on the Disk Tab.

v. Sonar On – Toggles the 4600 System On/Off. This feature can also be found under the DISCOVER Control Menu on the Towfish Control Tab.

vi. Normalize Data – Normalizes the side scan data with respect to the highest intensity. This feature can also be found under the DISCOVER Control Menu on the Video Gains Tab.

vii. Decrease Gain – Decreases the gain with respect to the highest intensity. This feature can also be found under the DISCOVER Control Menu on the Video Gains Tab.

viii. Current Gain Value – Shows the current gain value with respect to the highest intensity. This feature can also be found under the DISCOVER Control Menu on the Video Gains Tab.

ix. Increase Gain – Increases the gain with respect to the highest intensity. This feature can also be found under the DISCOVER Control Menu on the Video Gains Tab.

x. Auto Set TVG – Automatically sets the Time Varying Gain (TVG). This control compensates for spherical spreading and attenuation losses. This feature can also be found under the DISCOVER Control Menu on the Video Gains Tab and is called Norm TVG.

xi. Decrease TVG – Decreases the TVG. This feature can also be found under the DISCOVER Control Menu on the Video Gains Tab.

xii. Current TVG Value – Shows the current TVG value. This feature can also be found under the DISCOVER Control Menu on the Video Gains Tab.

xiii. Increase TVG – Increases the TVG. This feature can also be found under the DISCOVER Control Menu no the Video Gains Tab.

xiv. Mark – Places a mark in the recorded data where something might be of interest (this mark can be seen during playback). This feature is only located in the DISCOVER Toolbar Menu.

xv. Reset Displays – Resets the screen to the default display. This feature is only located in the DISCOVER Toolbar Menu.

xvi. Toggle Speed Correction – Toggles speed correction on/off. This function adjusts the display settings to make the image look more proportioned and is only located in the DISCOVER Toolbar Menu.

4.2.2 DISCOVER Control Menu

The DISCOVER *Control Menu* allows the user to turn the towfish on/off, adjust the range and gains, playback or record a side scan file, and displays the towfish status. These windows are displayed and described over the next few pages.

4.2.2.1 Towfish Control

Navigate to the Towfish Control Tab to turn the sonar On/Off by checking the Sonar On box or by clicking on the ON button from the Shortcut Menu. The range (m) and ping rate (%) can also be adjusted from this control menu. The range is specified per side. In the example below, the total swath is 200 m.

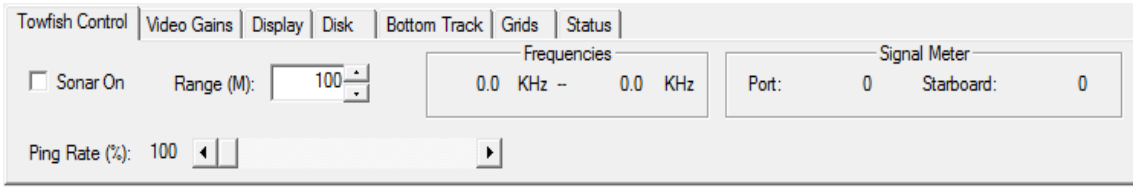


Figure 4-8: Towfish Control Tab

> **NOTE:** *If at any time, one or more of the systems (i.e. GPS, MRU, Sonar Head) have been disconnected or are not sending data to DISCOVER while the Sonar Head is ON, a window (Figure 4-8) will appear displaying the unavailable system(s).*

If this window appears, check the connection to the unavailable system(s). If the problem persists, please call **EdgeTech Customer Service**.

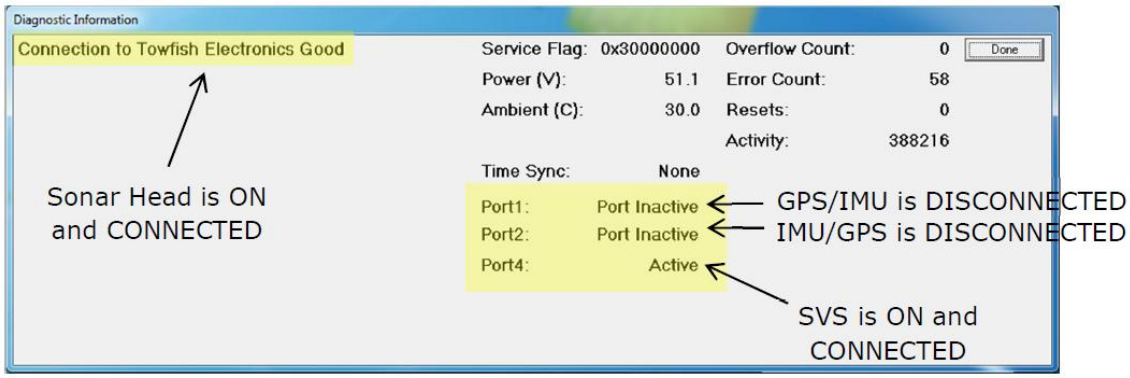


Figure 4-9: Diagnostic Window

4.2.2.2 Video Gains

The user can adjust the gain levels in DISCOVER to facilitate the viewing of the side scan waterfall. These levels can be regulated one of two ways.

- Using the *Video Gains Tab* (Figure 4-10)

- Using the Shortcut Menu on DISCOVER's main window (Figure 4-7, buttons vi through xiii).

The user can also adjust the Gain and TVG manually by either typing in the desired value or increasing/decreasing the value using the arrow buttons.

Figure 4-10: Video Gains Tab

> **NOTE:** *The gains are strictly used for viewing purposes and do not affect the processing of the bathymetry or side scan data.*

4.2.2.3 Display

The user can adjust the zoom and color palette by utilizing the Display Tab. These features are used solely on the customer's preferences.

Figure 4-11: Display Tab

4.2.2.4 Disk

To set up a recording directory, navigate to the Disk Tab and click Browse (red arrow). Usually the recording directory is located on the F:\Data Disk on the Topside Processor. When ready, press the Record button on the right hand side of the Disk Tab. The name of the file will appear in the Record File: box.

If the user does not specify a specific file name, DISCOVER will automatically name every file according to the date and time (UTC) the user hit record. For example, if the user hit record at 13:18 (UTC) on July 12, 2012 the file name will be recorded as 20120712131822.jsf.

Figure 4-12: Disk Tab

For basic playback, navigate to the *Disk* Tab (Figure 4-12) and select **Browse** (green arrow). Locate the desired JSF file and use the function buttons to play, stop, fast forward, etc. These playback buttons are also conveniently located on the *Shortcut Menu*.

> **NOTE:** *If a file was recorded in DISCOVER while data was being recorded in the 3rd party acquisition software, the file can be re-processed for bathymetric estimation using different parameters post-survey (please see Section 5.2.1 for more details). This recorded DISCOVER file provides useful for debugging and training purposes.*

4.2.2.5 Grids

DISCOVER also has the option to place a grid on the screen. The grid may facilitate measuring the size of a target or estimating its range from the sonar. The Grids Tab allows the user to place horizontal or vertical grids and to adjust the size and scale of these grids.

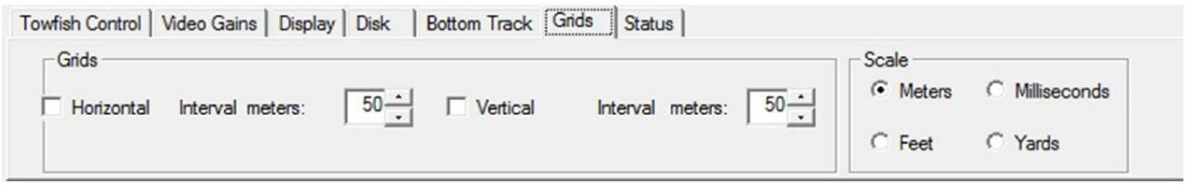


Figure 4-13: Grids Tab

4.2.2.6 Status

The Status Tab conveniently displays all of the important information for the system, such as navigation and sensor data.

Figure 4-14: Status Tab

4.2.3 Other Features in DISCOVER 4600

There are other features in DISCOVER that may be used during a survey. These functions are explained in this section.

4.2.3.1 Basic Bathymetry

To adjust the basic bathymetric processing parameters in DISCOVER, select **Bathymetry** from the Top Menu (designated as row A in Figure 4-4) and then Processing Parameters (Figure 4-15 and Figure 4-16).

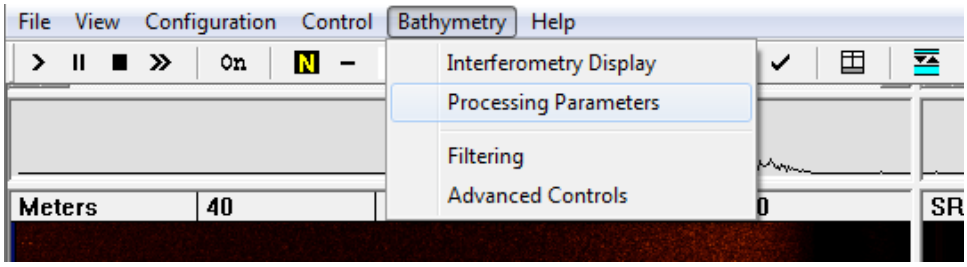


Figure 4-15: Discover 4600 Top Menu - Selecting Bathymetric Processing Parameters

Here you can turn on/off the BATHYMETRIC PROCESSOR, adjust the echo strength (1/10%), SNR filter (dB), and Minimum Process Range (m). This window also allows you to specify if you would like to use/not use the external limits given by the 3rd Party Interface. The recommended parameters are shown in Figure 4-16 for a silty/sand type seafloor.

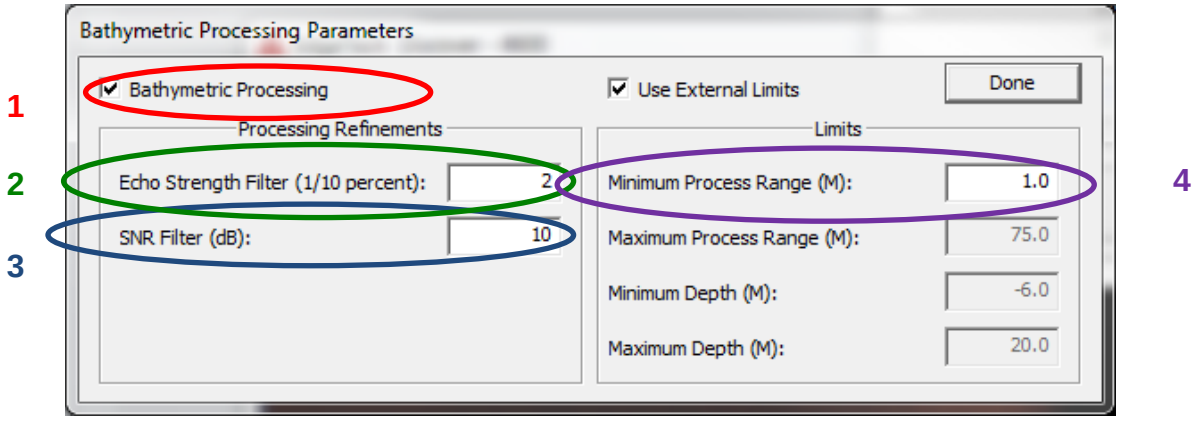


Figure 4-16: Basic Bathymetry

A few important things to know about basic bathymetry are discussed in items 1 through 4 and are highlighted in Figure 4-16:

1. If the **Bathymetric Processing** box is unchecked *during real time acquisition*, the system will act as a simple side scan system and will not compute or acquire any bathymetric solutions. If this is the case, the BATHYMETRIC PROCESSOR will remain dormant as in Figure 4-17.

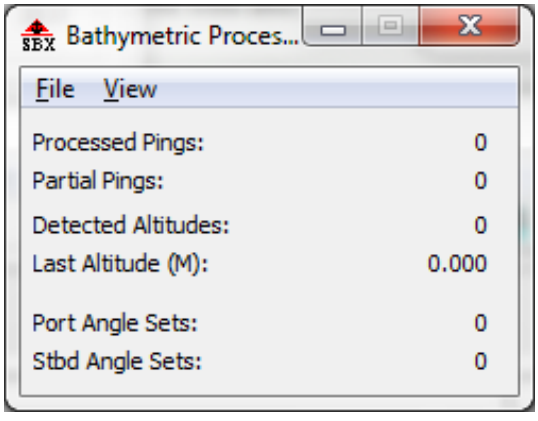


Figure 4-17: Disabled BATHYMETRIC PROCESSOR

If the Bathymetric Processing box is unchecked during playback, DISCOVER will playback the file exactly as it was collected. If the box is left checked, the BATHYMETRIC PROCESSOR will recalculate the seafloor solutions based on the

parameters set in Figure 4-16. So during acquisition and playback it is *very important* to pay attention to this feature. Typically this box is always checked because the Discover is normally used during real time acquisition.

2. The **Echo Strength Filter** is a fundamental attribute that is used primarily to exclude or trim weak echo points from the data, (i.e. water column and very weak backscatter amplitudes). The data points have an amplitude that can span 0 to 32,767. Typical sea floor echoes are above 300 to 1800, depending on the bottom type.

   The values that can be inputted to the system are based on 1/10% of this span, meaning that an echo strength of 320 is realistically 320/32767 x 100% = 0.98, and so the value that would be inputted to the system would be 1. In Figure 4-15 the input is 2, meaning that the seafloor echoes have an amplitude of approximately 650.

3. The **SNR Filter** is a valuable statistic used to trim bad data points near the outer swath, where the angle noise is high due to multipath effects. SNR values greater than 20 dB are excellent in terms of angle estimation noise, and less than 5 dB is very poor. Useful thresholds are between 5 – 20 dB, depending on the desire to have maximum swath (more noise) or lower noise and less swath. Typically this filter is set between 12 and 18 dB.

4. The **Minimum Processing Range** acts like a blanking range but in terms of slant range. The sonar will not process any data until it has reached this slant range limit. The default value is set to 1 m. Typically this parameter is not adjusted unless the user is surveying within constant deep water (greater than 50 m). If this is the case, the user may adjust this value to a much larger slant range (i.e. 5 – 10 m).

Another parameter the user should be aware of in terms of basic bathymetry is the **Last Altitude** (circled in green in Figure 4-18).

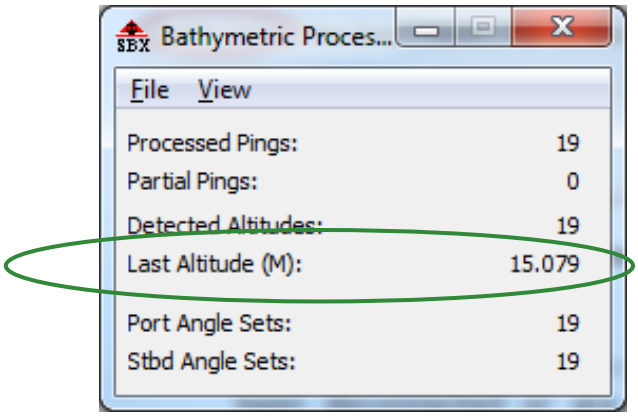


Figure 4-18: Bathymetric Processor

This value states the last depth the BATHYMETRIC PROCESSOR has calculated, in meters. If this value momentarily flashes red, it means that the BATHYMETRIC PROCESSOR has lost track of the bottom and will retain the last depth found for a short period of time. If the BATHYMETRIC PROCESSOR cannot find the bottom after several pings, this value will fall to 0, and will remain at 0 until it can find or track the bottom again.

If this should happen, the advanced processing parameters should be used to help the module find the bottom again (unless of course the seafloor has surpassed the operating limits of the sonar). The advanced parameters are discussed in the following section.

4.2.3.2 Advanced Bathymetry

To access the advanced processing parameters in DISCOVER, select **Bathymetry** from the *Top Menu* (Figure 4-19) and then **Advanced Controls** (Figure 4-19). Here you can disable/enable Auto Detect Altitude, adjust the multipath suppression levels and the maximum across track average size (m), and refine the advanced processing parameters.

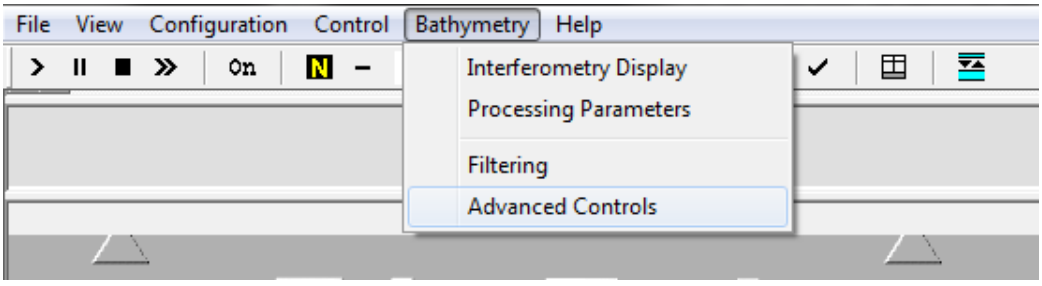


Figure 4-19: Discover 4600 Top Menu - Selecting Advanced Controls

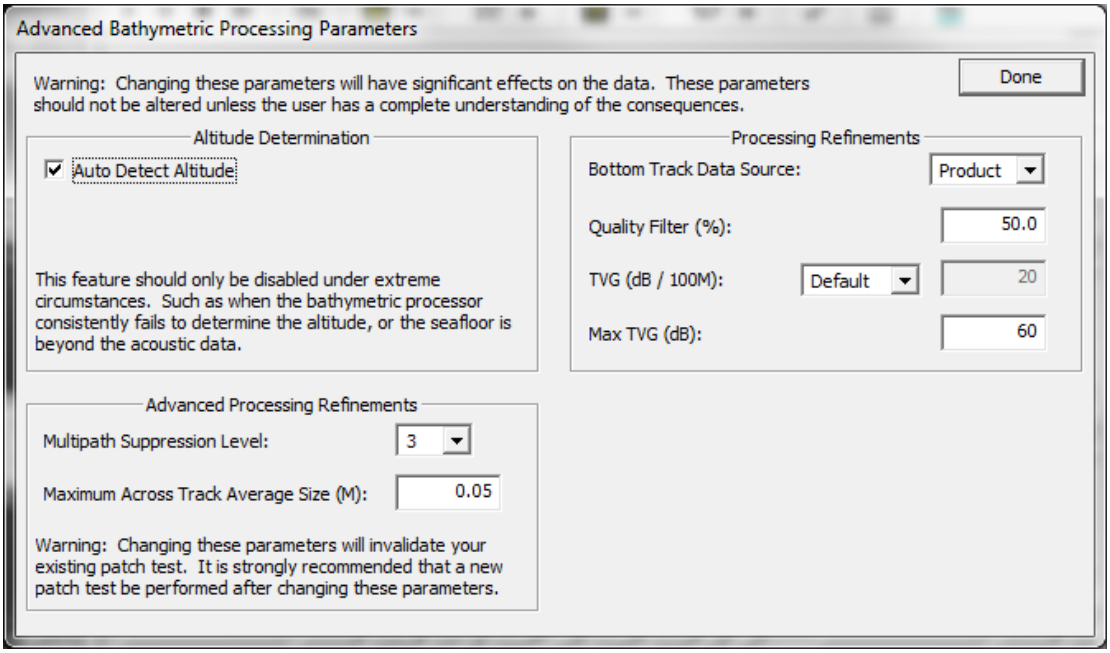

Advanced Bathymetric Processing Parameters
Warning: Changing these parameters will have significant effects on the data. These parameters should not be altered unless the user has a complete understanding of the consequences.
Done
Altitude Determination
Auto Detect Altitude
This feature should only be disabled under extreme circumstances. Such as when the bathymetric processor consistently fails to determine the altitude, or the seafloor is beyond the acoustic data.
Processing Refinements
Bottom Track Data Source:
Product
Quality Filter (%):
50.0
TVG (dB / 100M):
Default
20
Max TVG (dB):
60
Advanced Processing Refinements
Multipath Suppression Level:
3
Maximum Across Track Average Size (M):
0.05
Warning: Changing these parameters will invalidate your existing patch test. It is strongly recommended that a new patch test be performed after changing these parameters.

Figure 4-20: Advanced Bathymetry

These settings are described in detail. Please refer to Figure 4-20 for each description.

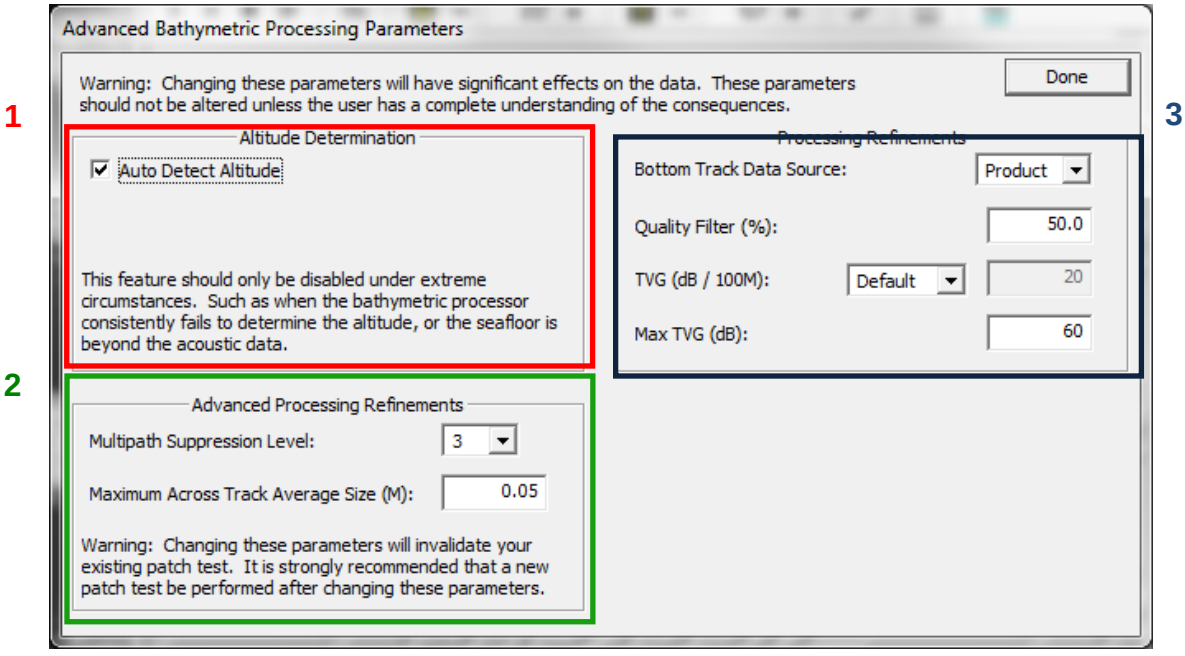

1
2
3
Advanced Bathymetric Processing Parameters
Warning: Changing these parameters will have significant effects on the data. These parameters should not be altered unless the user has a complete understanding of the consequences.
Done
Altitude Determination
Auto Detect Altitude
This feature should only be disabled under extreme circumstances. Such as when the bathymetric processor consistently fails to determine the altitude, or the seafloor is beyond the acoustic data.
Processing Refinements
Bottom Track Data Source:
Product
Quality Filter (%):
50.0
TVG (dB / 100M):
Default
20
Max TVG (dB):
60
Advanced Processing Refinements
Multipath Suppression Level:
3
Maximum Across Track Average Size (M):
0.05
Warning: Changing these parameters will invalidate your existing patch test. It is strongly recommended that a new patch test be performed after changing these parameters.

Figure 4-21: Advanced Bathymetric Processing Parameters

1. **Auto Detect Altitude**: This function tells the Bathymetric Processor to use its highly sophisticated algorithms to track the bottom. If the Auto Detect Altitude box is unchecked then the user has the opportunity to input a value in which they think the bottom resides.

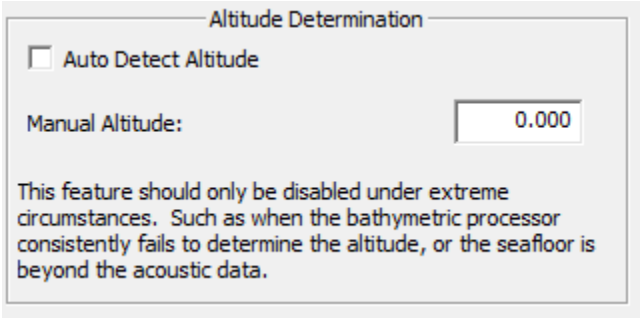

Altitude Determination
Auto Detect Altitude
Manual Altitude:
0.000
This feature should only be disabled under extreme circumstances. Such as when the bathymetric processor consistently fails to determine the altitude, or the seafloor is beyond the acoustic data.

Figure 4-22: Auto Detect Altitude Disabled

This feature should always be checked unless the system is tested under extreme circumstances. For example, if the bathymetric processor consistently fails to determine the altitude due to a complex environment, the user would then disable this function.

Such a complex environment (shown in Figure 4-23) can include surveying next to a large coral reef, where one array sees the reef bank and the other array does not see anything because there is nothing other than open ocean (would look like water column data). The user would determine the range to the reef bank (shown in Figure 4-23) and input this number into the **Manual Altitude** box (Figure 4-22). For the example below, the user would input 32 m (Figure 4-24).

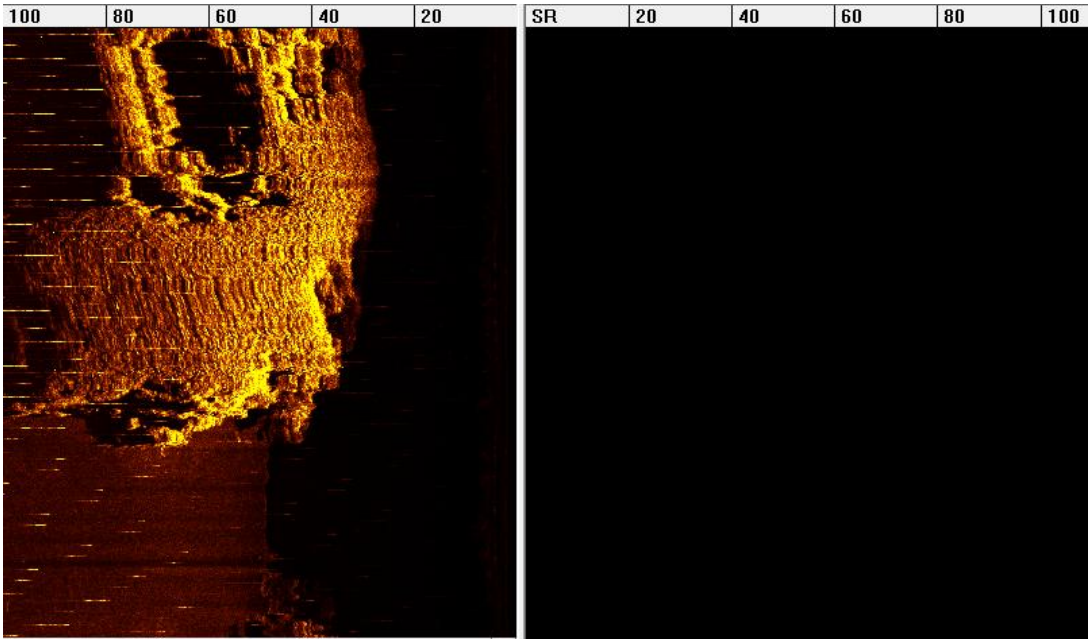


Figure 4-23: Example Extreme Circumstance - Surveying next to a reef bank

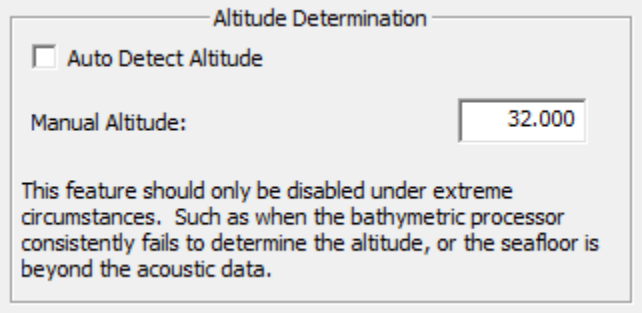

Altitude Determination
Auto Detect Altitude
Manual Altitude:
32.000
This feature should only be disabled under extreme circumstances. Such as when the bathymetric processor consistently fails to determine the altitude, or the seafloor is beyond the acoustic data.

Figure 4-24: Example Extreme Circumstance - Input Approximate Depth

2. **Multipath Suppression Level**: The multipath suppression level is a parameter that is used to specify how the beam forming is calculated. The data from the 8 half wavelength spaced elements can be combined prior to phase estimation processing to combat the effects of multipath signal propagation.

   Seafloor echoes arriving at the array from single or multiple bounces off the seafloor and the sea surface are the primary cause of poor angle estimation and across track range limitations in a shallow water deployed system. In deep water deployments, as may be seen on ROV or AUV mounted systems, this effect is much reduced, if not

eliminated. This parameter can take values between 1 and 3 and increasing this value combines more of the elements to combat the effects of multipath echoes.

- If this is set to 1, then no multipath suppression is applied and all 8 staves are used in the angle estimations. In the absence of multipath errors, this will result in good data.
- If this is set to 2, then adjacent element pairs are combined to help reject weak multipath echoes, resulting in 7 synthesized half wavelength spaced elements.
- If this is set to 3, then 3 adjacent elements are combined to help reject strong multipath echoes, resulting in 6 synthesized half wavelength spaced elements.

  In normal shallow water deployed systems, using a value of 3 gives the best result.

3. **Maximum Across Track Average Size:** In estimating the angles across track, multiple adjacent time samples may be combined to improve the signal to noise ratio prior to phase estimation. This is also a form of spatial averaging, which can be applied to the data prior to the angle estimation processing. This parameter determines the *maximum across track* region size that will be used in forming these averages, and is specified in meters.

   For output data with very high across track resolution, this value should be kept small, for example 0.05 to 0.5m (5 to 50 cm). For less resolution and more averaging, region sizes up to 1m can be used to produce good effects in some cases (deep water).

4. **Processing Refinements**: These parameters are explained in detail in order of appearance.

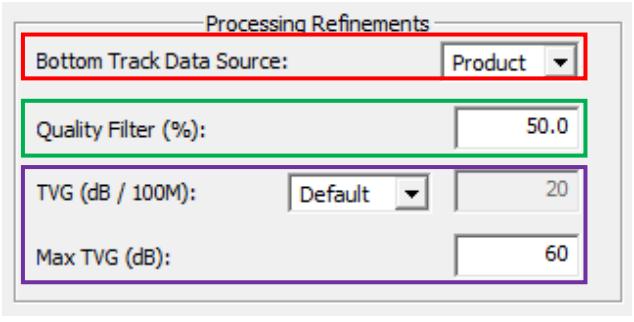


Figure 4-25: Processing Refinements - Advanced Controls

a. The default setting for the **Bottom Track Data Source** is **Product**. This means the BATHYMETRIC PROCESSOR takes the product of the information coming from both arrays to estimate the seafloor depth. This setting seems to work well in most scenarios, especially for heavy boat traffic areas where boat wake is prominent, but three other parameters have been added for those special cases a user may face. These three other settings are **Port**, **Starboard**, and **Sum**.

   The **Port** and **Starboard** settings state that the BATHYMTERIC PROCESSOR should only use the port or starboard side only to compute the seafloor depth. For instance, if the 4600 is mounted on the side of a survey vessel, there is the possibility that the 4600 will observe one or more hull echoes on its side facing the boat. If this is the case, you would choose **the Bottom Track Data Source** as the clear side, whether that be **Port** or **Starboard** (as shown in Figure 4-26).

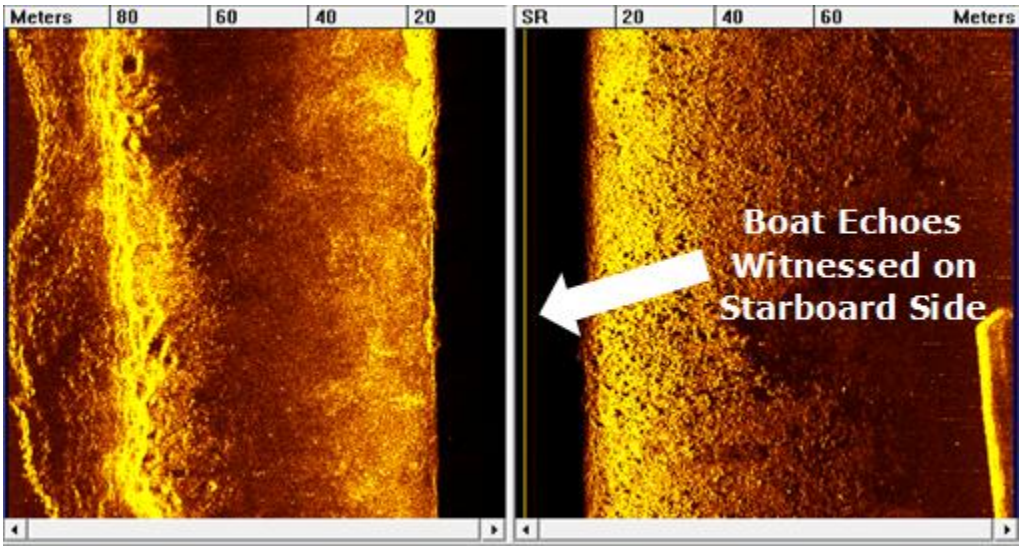


Figure 4-26: Boat Echo Example

This tells the BATHYMETRIC PROCESSOR to use the clear side *only* when tracking the seafloor. If it were to use the side facing the boat, there is a chance that the BATHYMETRIC PROCESSOR will use the hull echo as its first bottom return, therefore locking the bottom tracker to the hull echo, leading to false measurements.

Another case where Port or Starboard may be used is if one of the arrays should fail, or the seafloor is beyond the limits of the sonar. This way the user will still be able to carry out a survey, even though one side of the system does not work, or does not see the seafloor.

The *Minimum* setting tells the BATHYMETRIC PROCESSOR to use the lowest amplitude return for the bottom tracking algorithm. In this case, if there were any high amplitude points within the water column, the BATHYMETRIC PROCESSOR would ignore these points and search for the points that had the lowest amplitude. The bottom track function would then lock on to those lowest amplitude points, (which is hopefully the bottom) and track these accordingly.

Lastly, Sum tells the BATHYMETRIC PROCESSOR to sum the information from both sides of the arrays to calculate a depth estimate for the seafloor. This parameter is the least effective of the four and should rarely be used

b. **Quality Filter (%)**: In practice, measured interstave phases may either agree quite well, +/- 5° to 10°, or not at all, up to +/- 90°. The quality filter metric is a measure of how good the interstave measurements are and is defined as

100% = phase differences equal to 0 (i.e. not possible in practice; setting the quality factor to 100% will exclude all data points.
80% = has a +/- 20° tolerance
70% = has a +/- 30° tolerance
60% = has a +/- 40° tolerance
50% = has a +/- 50° tolerance
25% = has a +/- 90° tolerance
0% = allows all data points to pass through.

For most cases any data with a quality factor less than 50% should be discarded.

c. **Time Varying Gain**: This option allows the user to apply TVG in dB per 100m to the bathymetry solutions. EdgeTech has incorporated this feature to increase the bathymetry range in soft bottom conditions.

This parameter can have one of three options as described below:

- *Default*: this option adjusts the TVG according to the operating frequency and requires no input from the user.

- *Display*: this option applies the TVG set in the display settings as shown in Figure 4-27. This option requires constant monitoring of the side scan imagery and the TVG must be normalized as the composition of the seafloor changes.

  This can be done by clicking on the T button, or it can be manually adjusted by using the + or – buttons (see Figure 4-27).

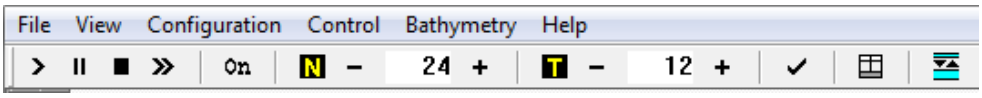


Figure 4-27: Discover Toolbar Menu

- *Manual*: this option allows the user to input a manual TVG value. This number is specified in the box to the right of the drop down menu. When this option is selected, the user can also specify a maximum TVG value in the Max TVG (dB) field (see Figure 4-28). This option also requires constant monitoring of the side scan imagery so that the correct TVG value is applied to the bathymetric solutions.

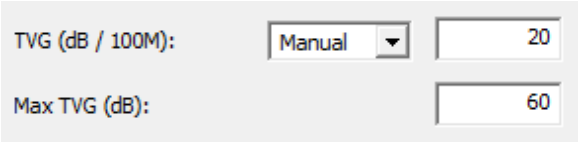


Figure 4-28: Inputting a Manual TVG

NOTE: *If TVG mode is activated, then the Echo Strength Filter in the Basic Bathymetry Parameters can be increased to reduce noise at the extremities of the bathymetry solutions. Monitoring the results in the Interferometry window will help the user determine what TVG value is best for the current conditions. (The Interferometry window is explained in the following section.)*

Once these parameters under the **Advanced Controls** have been set **do not** change them during a survey. This will require you to perform another calibration patch test, so it is very important to set these parameters correctly.

4.2.3.3 Interferometry

DISCOVER now offers an interferometry display. This window displays the raw interferometry points before binning and averaging, and is not corrected for motion. This display can be accessed by selecting **Bathymetry** from the *Top Menu* and then **Interferometry Display** as in Figure 4-29 and Figure 4-30.

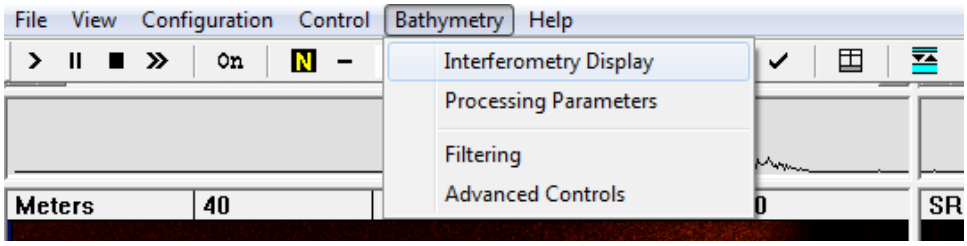


Figure 4-29: Activating the Interferometry Display

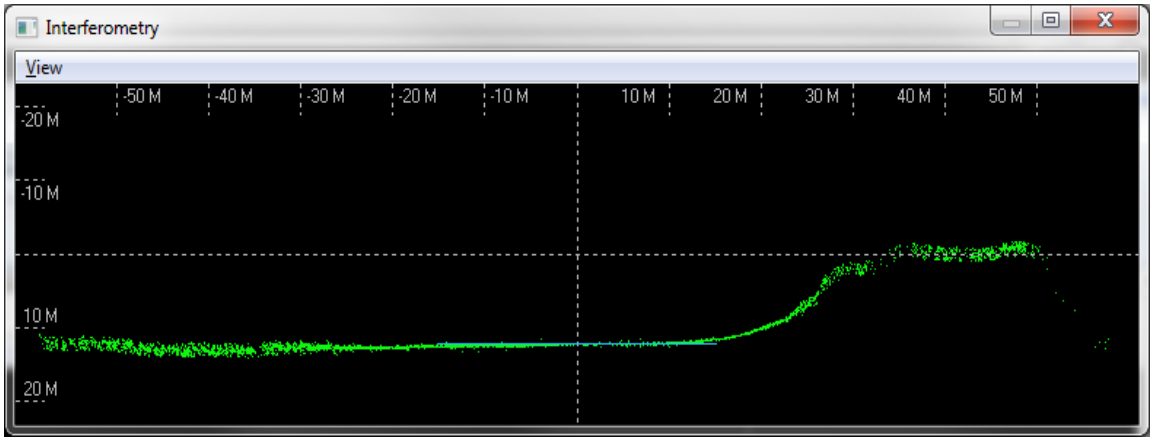


Figure 4-30: Interferometry Display

The Interferometry Display allows the user to see the effects of the various filters built in to DISCOVER. The built in filters are listed below and each have a designated color associated with it.

- Echo Strength Filter (red)
- Quality Filter (orange)
- SNR Filter (yellow)
- Water Column Filter (blue)
- Outlier Filter (purple)

The BATHYMETRIC PROCESSOR also offers a **Data Filtering** Dialog. To access it, simply click on Bathymetry, and then **Filtering** as shown in Figure 4-31.

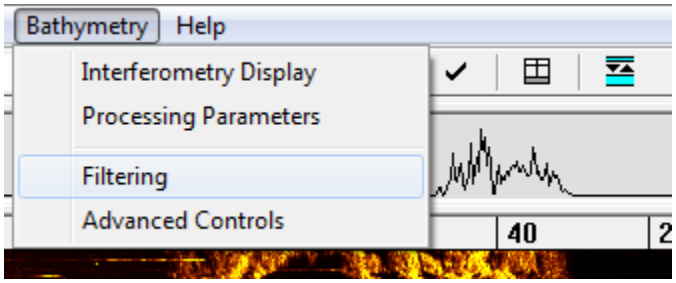


Figure 4-31: Accessing the Filtering Options

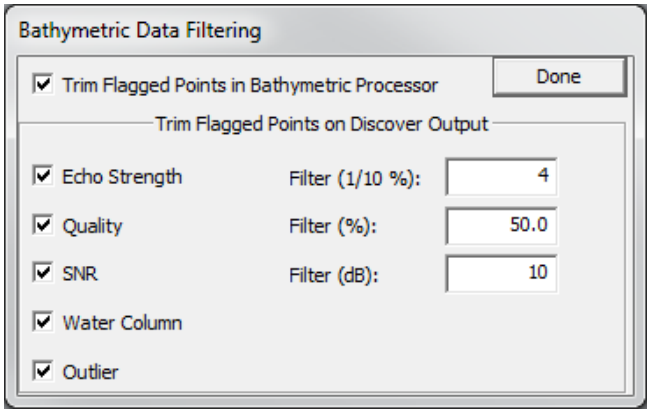


Figure 4-32: Filtering Options

Each filter has a designated color for easier viewing within the Interferometry window. To view the different filters, the user must first uncheck the *Trim Flagged Points in Bathymetric Processor* in Figure 4-32, then select VIEW from the top of the Interferometry screen (Figure 4-33), and then select a desired filter. The green points, known as *Unfiltered Points*, display the data that has passed all filters and is designated as valid data.

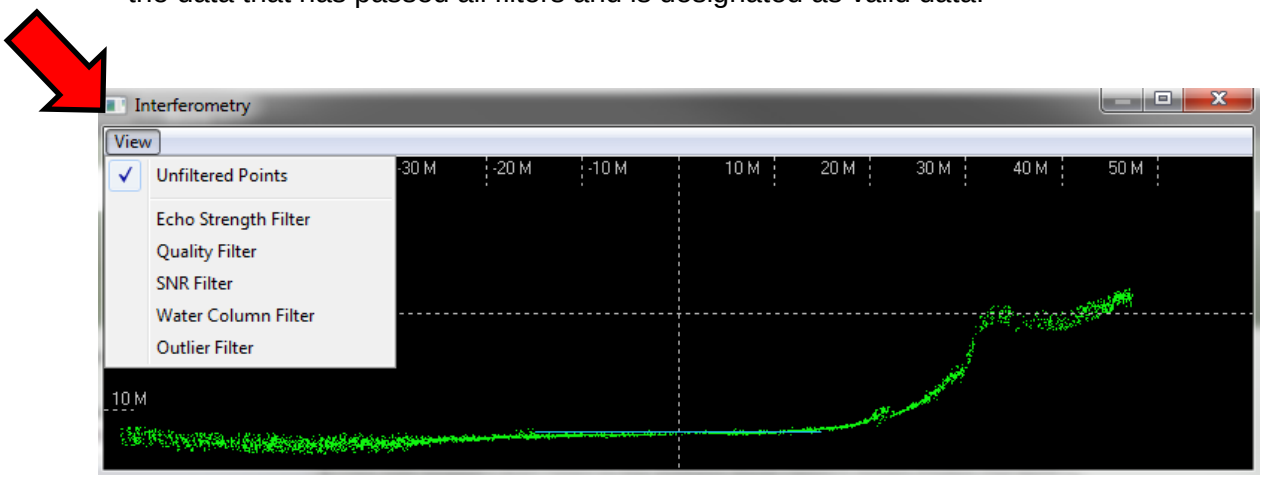


Figure 4-33: Viewing the Filters in the Interferometry Window

As a reminder, the **Echo Strength** and **SNR** filters are controlled in the Basic Processing Parameters window, while the **Quality** filter is within the Advanced Controls. The Water Colum and Outlier Filter are always enabled.

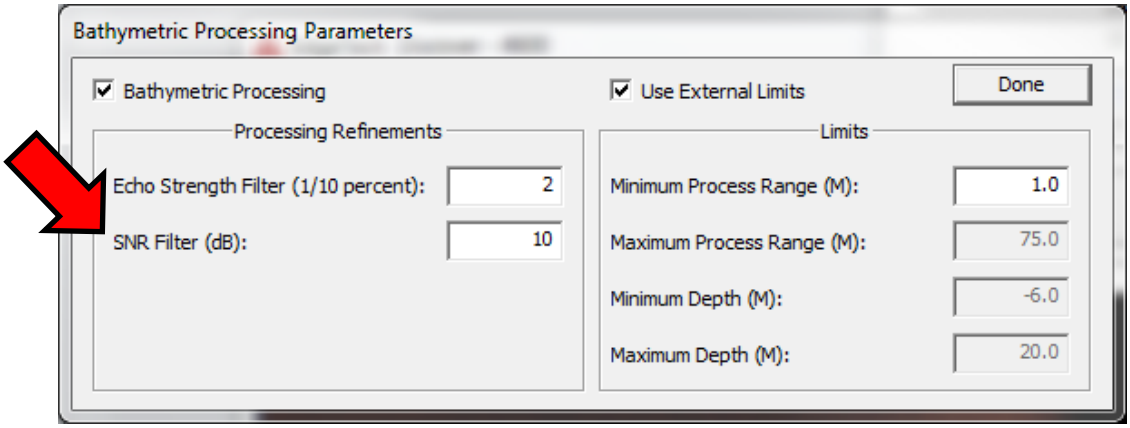


Figure 4-34: Basic Bathymetric Controls

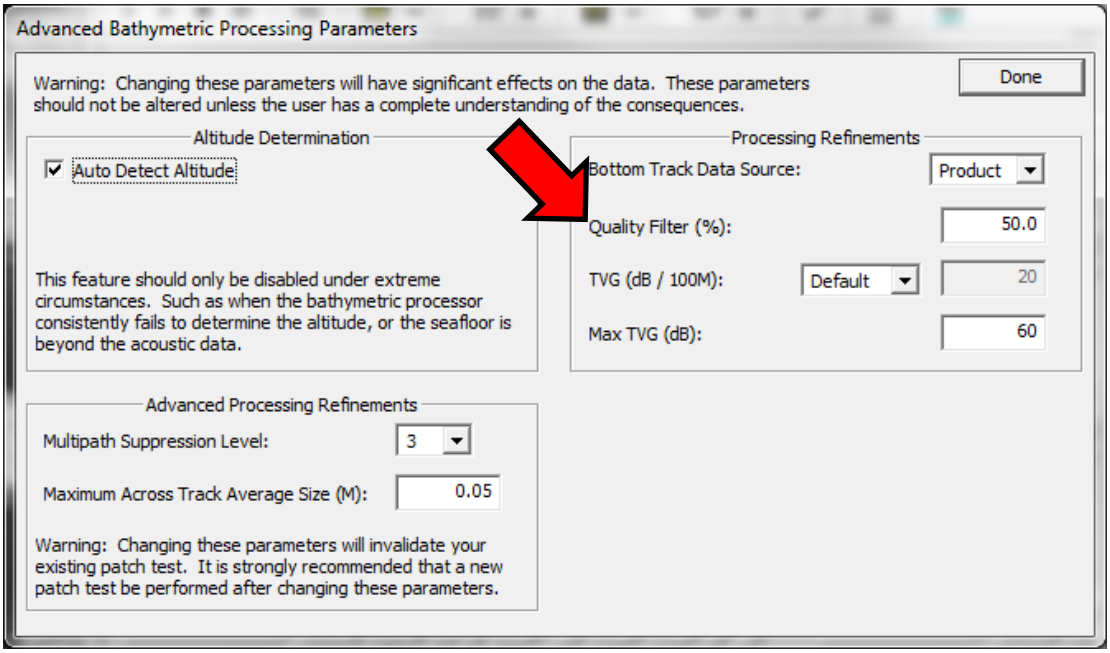

Advanced Bathymetric Processing Parameters
Warning: Changing these parameters will have significant effects on the data. These parameters should not be altered unless the user has a complete understanding of the consequences.
Done
Altitude Determination
Auto Detect Altitude
This feature should only be disabled under extreme circumstances. Such as when the bathymetric processor consistently fails to determine the altitude, or the seafloor is beyond the acoustic data.
Processing Refinements
Bottom Track Data Source:
Product
Quality Filter (%):
50.0
TVG (dB / 100M):
Default
20
Max TVG (dB):
60
Advanced Processing Refinements
Multipath Suppression Level:
3
Maximum Across Track Average Size (M):
0.05
Warning: Changing these parameters will invalidate your existing patch test. It is strongly recommended that a new patch test be performed after changing these parameters.

Figure 4-35: Advanced Bathymetric Controls

If the user would like to allow certain points to pass through the Discover output and handed off to the third party topside software, all the user has to do is uncheck the corresponding filter box in Figure 4-32.

The filtering parameters are repeated in the Bathymetric Data Filtering window for easier access between the dialogs. If a value is changed in the Basic Bathymetry Controls Figure 4-34), the change is reflected in the Filtering window (Figure 4-33), and vice versa.

4.2.4 Engineering Displays

DISCOVER and the BATHYMETRIC PROCESSOR offer a few more features for troubleshooting and training purposes. These engineering displays are described below and are usually not displayed during normal surveying conditions.

4.2.4.1 Connection Status

In the DISCOVER main window (Figure 4-4), locate *View* from the *Top Menu* and select *Connection Information*. Here, you will find the *Sonar Control* and *Sonar Data* connections status window (Figure 4-36). This window displays the connections status between the **DISCOVER 4600** and the installed **External Topside Interface**. To turn this window off, click **Done**.

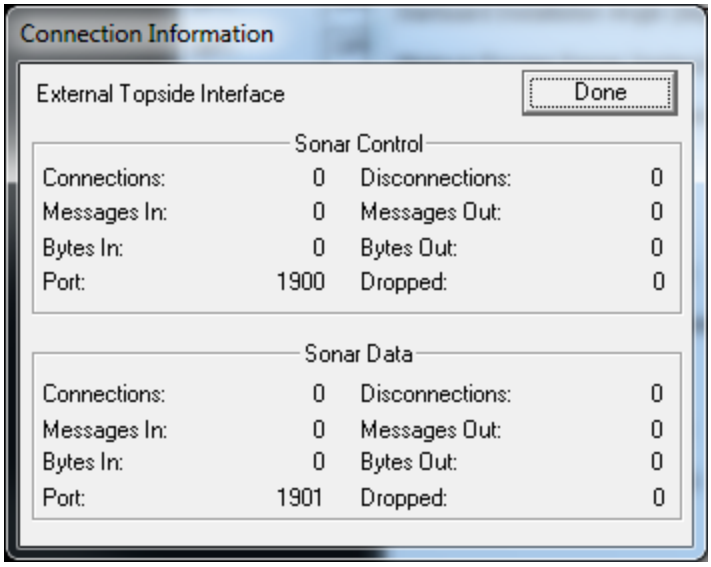


Figure 4-36: Connection Information

If any Disconnections are witnessed under any one of these two sections, please check to see if the correct password was installed. For help in doing so, please contact **EdgeTech Customer Service**.

You can also check the connection status between the BATHYMETRIC PROCESSOR and DISCOVER 4600. This can be done by selecting *View* > *Connection Status* from the BATHYMETRIC PROCESSOR's Top Menu (Figure 4-37).

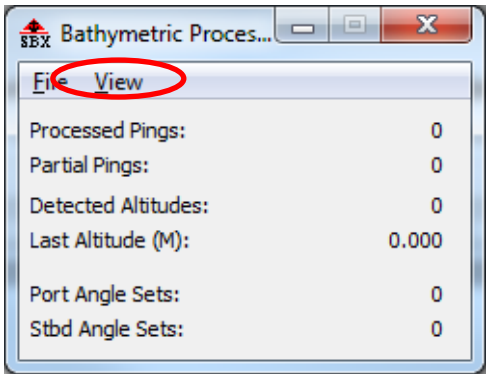


Figure 4-37: Bathymetric Processor

The following window should appear:

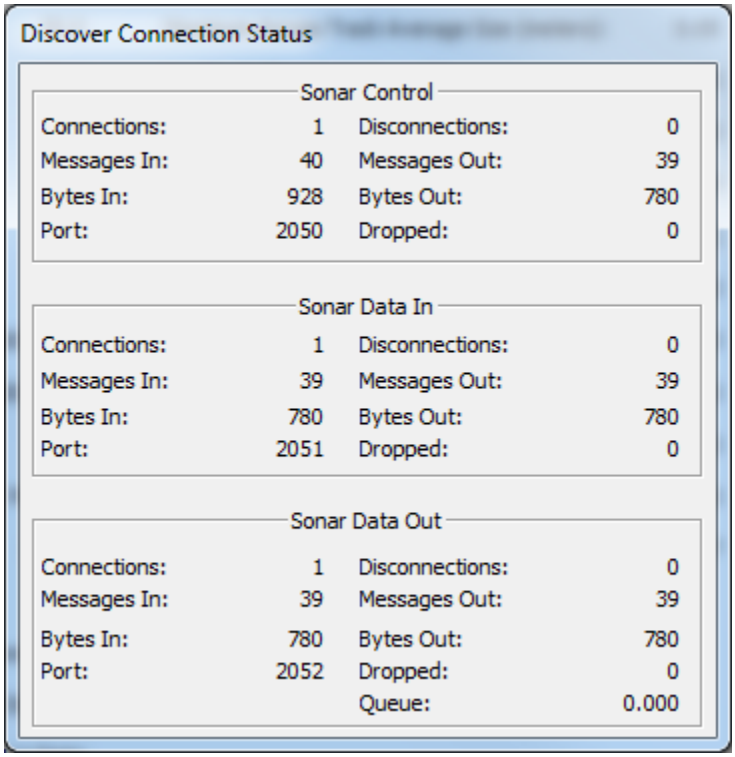


Figure 4-38: Connection Status Window

Here you will find the *Sonar Control*, *Sonar Data In*, *and Sonar Data Out* connections status window (Figure 4-38). To turn off this window, simply click on View from the Top Menu (Figure 4-37) and uncheck the Connection Status window. If any Disconnections are witnessed under any one of these three sections, please turn all systems off and reboot. If the problem persists, please contact **EdgeTech Customer Service**.

4.2.4.2 Situation Status

From the *Top Menu* of the Main DISCOVER window, under *View* > *Situation Status* you will find the number of incoming processed messages from each connected serial port (Figure 4-39). To turn off this window, simply navigate to *View* > *Situation Status* and uncheck it.

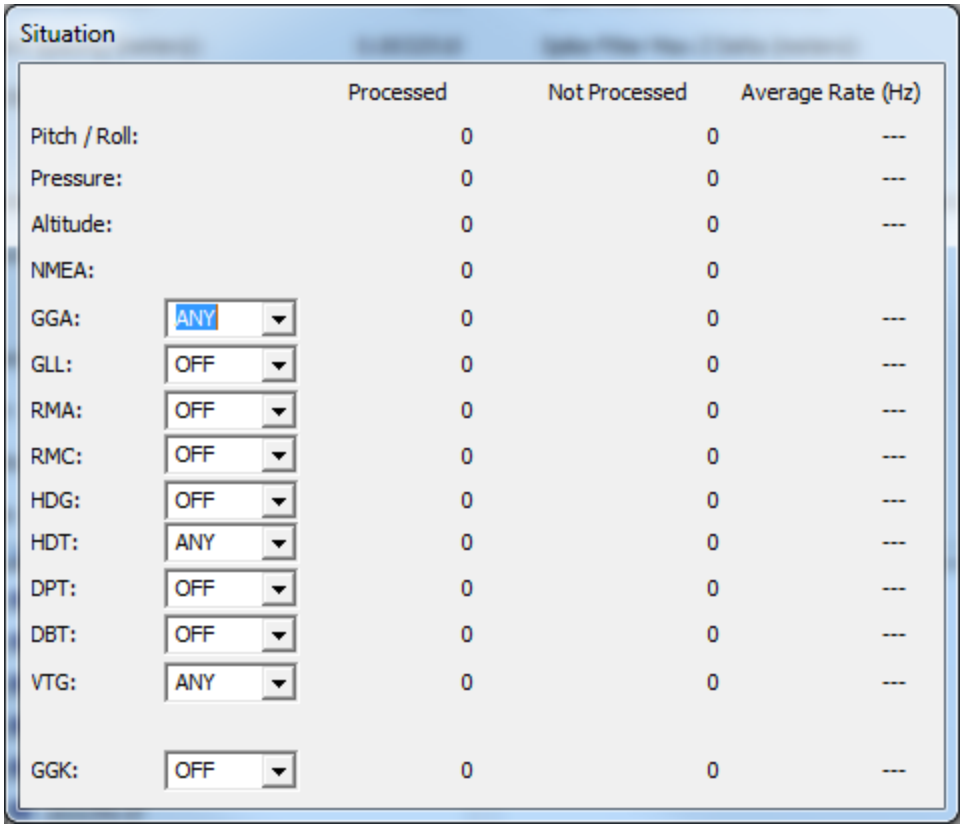

Situation
Processed
Not Processed
Average Rate (Hz)
Pitch / Roll: 0 0 ---
Pressure: 0 0 ---
Altitude: 0 0 ---
NMEA: 0 0
GGA: ANY 0 0 ---
GLL: OFF 0 0 ---
RMA: OFF 0 0 ---
RMC: OFF 0 0 ---
HDG: OFF 0 0 ---
HDT: ANY 0 0 ---
DPT: OFF 0 0 ---
DBT: OFF 0 0 ---
VTG: ANY 0 0 ---
GGK: OFF 0 0 ---

Figure 4-39: Situation Status

Here you can assign a specific COM port for each message, or set the field to ANY and the Bathymetric Processor will automatically find the message on which it is being parsed. Also there is the option to turn OFF the message.

If any checked NMEA messages are showing zero, please check the power on the device that is outputting those strings. This same procedure is followed if the pitch/roll processed value is also showing 0. If the problem persists, please contact **EdgeTech Customer Service**.

4.2.4.3 Processing Parameters

Under *View* > *Engineering Displays* > *Processing Parameters* you will find important information about the 4600 system (Figure 4-40). Some fields include the array installation angles (in degrees) and element spacing (in meters), multipath suppression level, altitude determination source (also known as Bottom Track Data Source), etc. To turn off this window, simply navigate to *View* > *Engineering Displays* > *Processing Parameters*.

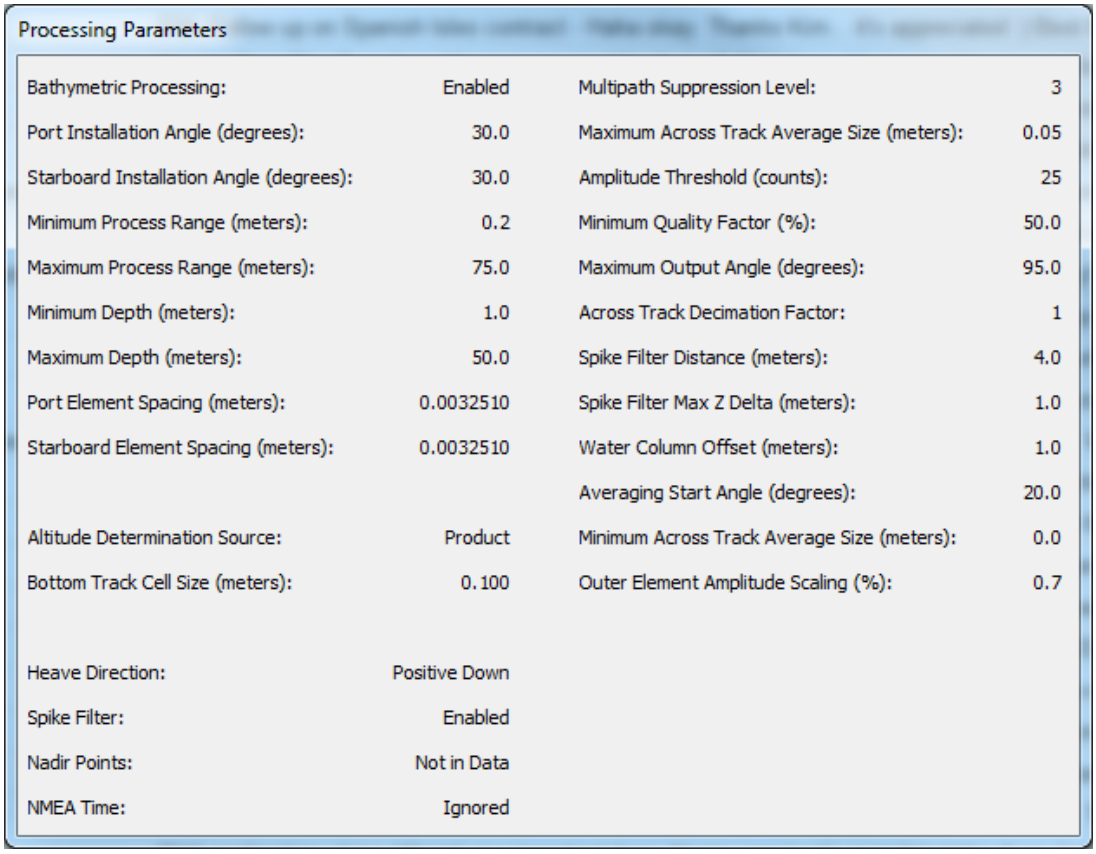

Processing Parameters
Bathymetric Processing: Enabled
Port Installation Angle (degrees): 30.0
Starboard Installation Angle (degrees): 30.0
Minimum Process Range (meters): 0.2
Maximum Process Range (meters): 75.0
Minimum Depth (meters): 1.0
Maximum Depth (meters): 50.0
Port Element Spacing (meters): 0.0032510
Starboard Element Spacing (meters): 0.0032510
Altitude Determination Source: Product
Bottom Track Cell Size (meters): 0.100
Heave Direction: Positive Down
Spike Filter: Enabled
Nadir Points: Not in Data
NMEA Time: Ignored
Multipath Suppression Level: 3
Maximum Across Track Average Size (meters): 0.05
Amplitude Threshold (counts): 25
Minimum Quality Factor (%): 50.0
Maximum Output Angle (degrees): 95.0
Across Track Decimation Factor: 1
Spike Filter Distance (meters): 4.0
Spike Filter Max Z Delta (meters): 1.0
Water Column Offset (meters): 1.0
Averaging Start Angle (degrees): 20.0
Minimum Across Track Average Size (meters): 0.0
Outer Element Amplitude Scaling (%): 0.7

Figure 4-40: Processing Parameters

4.2.4.4 Processing Details

Under View > Engineering Displays > Processing Details you will find the processing details (Figure 4-41: Processing Details). Some fields include the number of processed and partial pings, detected altitudes, last altitude detected (in meters), and percent queues. Some of these details have been repeated in the BATHYMETRIC PROCESSOR Main Window (Figure 4-4, right). To turn off this window, simply navigate to *View* > *Engineering Displays* > *Processing Details*.

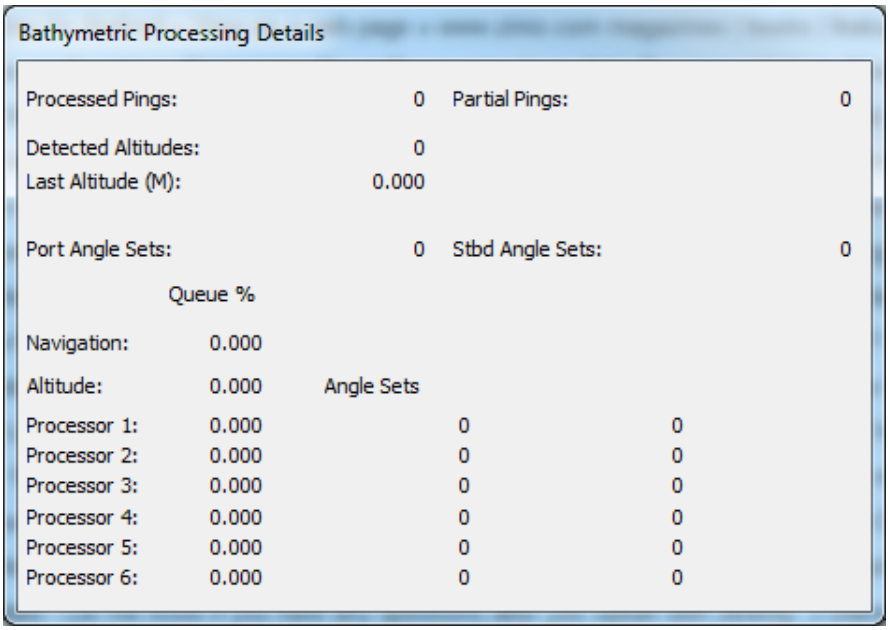


Figure 4-41: Processing Details

4.3 Third Party Software

Currently, HYPACK and QINSy are the only software that has been approved by EdgeTech, but work continues to expand the number of available topsides. A brief description is listed in below.

4.3.1 HYPACK

The processed bathymetry and side scan data is sent in real-time to the HYPACK®/HYSWEEP® survey applications. These application display and record the bathymetric data in HYPACK's HSX format. These HSX files can then be used off line in the MBMax, Side Scan Mosaic, and other proprietary packages that support these formats, to edit, clean, and mosaic the collected data.

A complete guide on how to use HYPACK with the EdgeTech 4600 system is given in the ***HYPACK Software Guide for the EdgeTech 4600 System***.

4.3.2 QINSy

Bathymetry and side scan data is sent in real-time to the QINSy survey applications. These applications display and record bathymetric and side scan data in QINSy's native format. These files can then be processed offline to create final bathymetric and side scan products.

SECTION 5: FREQUENTLY ASKED QUESTIONS

This section provides a list of frequently asked questions pertaining to the EdgeTech 4600 Swath Bathymetry and Side Scan System.

[1] *Which frequency is better? The 230 kHz or the 540 kHz?*

Both systems work very well, but each has its own benefits depending on the environment, water depth, and application. For customers who mainly operate in open ocean environments with a depth of 30 to 100 meters of water, the 230 kHz system is the optimal solution.

For customer's surveying mostly in channels, creeks, and other enclosed bodies of water and operating in depths of about 2 to 30 meters, the 540 kHz system is the best fit. Please contact **EdgeTech Customer Service** for more information on the benefits of each system.

[2] *Does the 4600 system interface to Ethernet devices?*

Currently, the 4600 system can only interface to supporting sensors via the three COM ports (RS-232) in the back of the Topside Interface Box. Please check with EdgeTech as it is an upcoming feature.

[3] *Where is the best place to mount the 4600 Sonar Head on the survey vessel?*

The bow of a survey vessel is always the best place to mount the 4600 Sonar Head. By placing the system at the bow, the sonar will most likely be far enough away from most interferences such as hull echo(es), propeller noise, wake, etc.

[4] *How long can I keep my 4600 Sonar Head in the water for?*

The 4600 system was not designed with a permanent submerged installation in mind. It is recommended that the 4600 system remain submerged no longer than 2 weeks at a time, especially in warm salty waters. Fouling and corrosion may degrade the measurements of the 4600 system and/or the sound velocity sensor in the nose of the Sonar Head. It is recommended that the arrays' faces be checked

regularly, and if fouling is observed, clean them using a wash cloth with mild soap and fresh water. It is also recommended that the SVS in the nose is regularly inspected and cleaned, as well as calibrated once every two years.

[5] *How often should I rinse my system?*

Please rinse the 4600 Sonar Head after every mission. Please pay special attention to the SVS in the nose and the connectors in the tail, rinsing them thoroughly using the rinse holes provided. Also, it is a good idea to rinse the deck cable and flush its track using the keyway at the top of the mounting bracket.

[6] *What if the Topside Processor or Topside Interface does not turn on?*

If the Topside Processor or Topside Interface does not turn on, please check the on/off switch in the back of the 19" mountable rack. Both are located next to the power plug of their respective box.

[7] *Do I always need a sound velocity cast?*

It is always a good idea to collect a sound velocity profile, especially in the area where you collected your patch test data. Most likely the water you are operating in does not have a uniform sound velocity, and depending on how drastic the profile is, a depth error as large as 1.6 m can occur.

[8] *Can I incorporate RTK Tide measurements with the 4600 system?*

Yes. HYPACK and QINSy have the ability to record this information within their native data files. Please refer to their corresponding manuals for more information.

[9] *Why can't I feed navigation directly into the Topside Computer?*

In order for the 4600 to properly process the bathymetry data, it needs all of the supporting information, such as position, heading, roll, pitch, and heave. By inputting the supporting device directly into the computer poses a risk of

mismatching time stamps. If the time stamps do not match, the bathymetric processor will not know how to correct the data

[10] *How often should I connect to the Remote Desktop Connection (Sonar.exe) and check to see the status of the supporting data?*

You should only need to do this if a device is not connected properly. Usually this is done during training with an experienced representative from EdgeTech. It is not recommended for users to connect to the sonar without EdgeTech support.

[11] *What do I do if I do not see data scrolling in DISCOVER?*

Check to see if the Sonar Head has connected to DISCOVER by checking the status of the network (**NET: ON**) down in the right hand corner of the DISCOVER main window (please see sub-section **4.2**). It usually takes about a minute and a half for the Sonar Head to boot and connect to the Topside Processor. If the problem persists, please contact **EdgeTech Customer Service**.

[12] *What do I do if the Diagnostic window will not disappear, even after I've clicked Done?*

If DISCOVER is connected, check the Diagnostic window for any missing data on any of the three/four COM ports (depending on how your system has been configured). If one Port is showing "Port Inactive," check the connection of the device and the Topside Interface Box. If a Port is showing "Unknown Data", check the format of the devices output data. Ensure the data format follows sub-section **2.5** of this manual). If the problem persists, please contact **EdgeTech Customer Service**.

[13] *Can the 4600 System measure pilings or vertical objects?*

The 4600 system itself can measure vertical objects, but the third party software is not configured to do so at this time. Currently, the system acquires data that is then binned and averaged according to a specified number of horizontal bins by the third party. In doing so, the software can only plot horizontal features and so it should not

be relied upon to plot vertical objects. Please check with EdgeTech as this is an upcoming feature.

[14] *If I am constantly surveying within a channel, should I adjust the Multipath Suppression Level?*

If you are consistently surveying within a channel, the Multipath Suppression Level can be adjusted to 1. This will give you more soundings along the bank of the channel but it will decrease the number of soundings measured at Nadir.

[15] *Why do I have to redo my patch test after changing the Multipath Suppression Level and/or Maximum Across Track Average Size (m)?*

The Multipath Suppression Level and the Maximum Across Track Average Size are parameters used by the BATHYMETRIC PROCESSOR to estimate the depths of the seafloor. Changing these parameters alters the way the soundings and installation offsets are computed, so it is very important to re-acquire the Patch Test data once these limits have been modified.

[16] *What is the difference between the options listed under Bottom Track Data Source (Port, Starboard, Sum, or Product)?*

The Bottom Track Data Source parameter states how the BATHYMETRIC PROCESSOR should calculate the depth of the seafloor. These options include using the port side array only, starboard side array only, or take the product of both arrays. A more detailed explanation is provided in Section 5.2.1 of this manual.

[17] *What do I do if I do not see data scrolling in my Third Party Software?*

Check to see if DISCOVER is connected to your Third Party Software following the directions stated in sub-section **4.2.2** .

[18] *The 4600 system connects with Hypack and QINSy, why doesn't connect with other topsides?*

EdgeTech has approved a small number of Third Party Topsides for acquisition and processing of the bathymetry and side scan data. Currently, only HYPACK and QINSy software have been approved, but work continues to expand the number of topsides. Please contact EdgeTech for updates.

[19] *What should I do if my Topside crashes?*

Please contact **EdgeTech Customer Service** immediately so we can help restore your system and get you back up and running as soon as possible.

APPENDIX A: CONFIGURING THE COM PORTS

There are 3 available COM ports on the Interface Box to provide the necessary information to the 4600. This information includes position (latitude/longitude), heading, attitude (roll, pitch, and heave), and time. This section explains how to configure the three COM ports depending on what type of sensors are used.

A.1 One Sensor

One sensor, such as the Applanix PosMV, may be used to supply position (latitude/longitude), heading, attitude, and a time source. For this type of configuration, only COM1 will be utilized.

To configure the COM ports for one sensor, the following steps should be carried out:

1. Turn on the 4600 Topside Processor and connect the 4600 via the deck cable to the Topside Interface Box.

2. Turn on the 4600 Sonar Head and run the Remote Desktop Application, named Sonar. The main screen as in Figure A-1 should appear.

   Here, you will see the Sonar Application running (designated by the blue arrow). This is the firmware that controls the system.

3. Click on the 'X' at the top right to close the firmware.

4. Now, double click on the *Shortcut to EdgeTech* icon (red arrow, Figure: A-2) and open the *SSSonar* folder, then the *Sonar* folder.

5. Look for the *SonarSerial.ini* file (Figure A-3) and open it using WordPad or Notepad (Figure A-4).

6. Under [Serial2] and [Serial3] set Create = 0, select *File* > *Save*, and close the file. **Do not** make any other changes. This will deactivate COM ports 2 and 3. By deactivating these ports, Sonar will report to Discover that only one sensor is to be used on COM1 to parse the necessary sensor information. Therefore, Discover will not throw up any errors if a sensor is not connected to COM2 or COM3.

   If steps 3 through 6 were not carried out, then these errors would be reported in the Diagnostic window (Figure A-5).

7. Close the SonarSerial.ini file and reboot the Sonar Firmware by double clicking on the Sonar icon in the main Sonar Remote Desktop Screen (designated by the green arrow in Figure A-6).

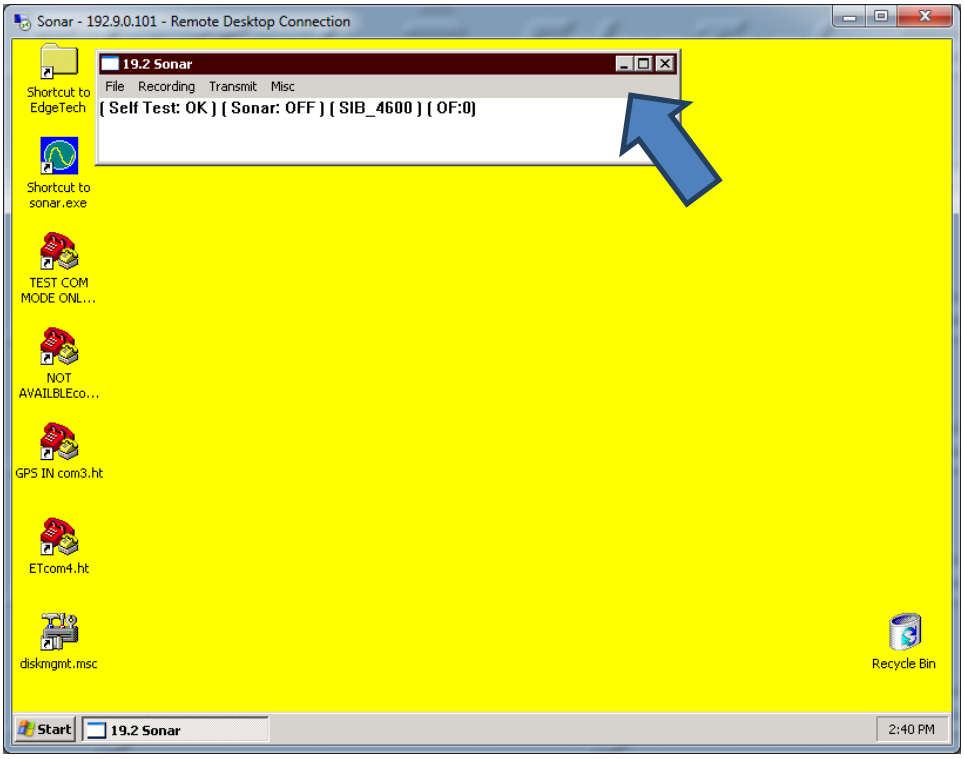


Figure A-1: Sonar Remote Desktop Application, Main Screen

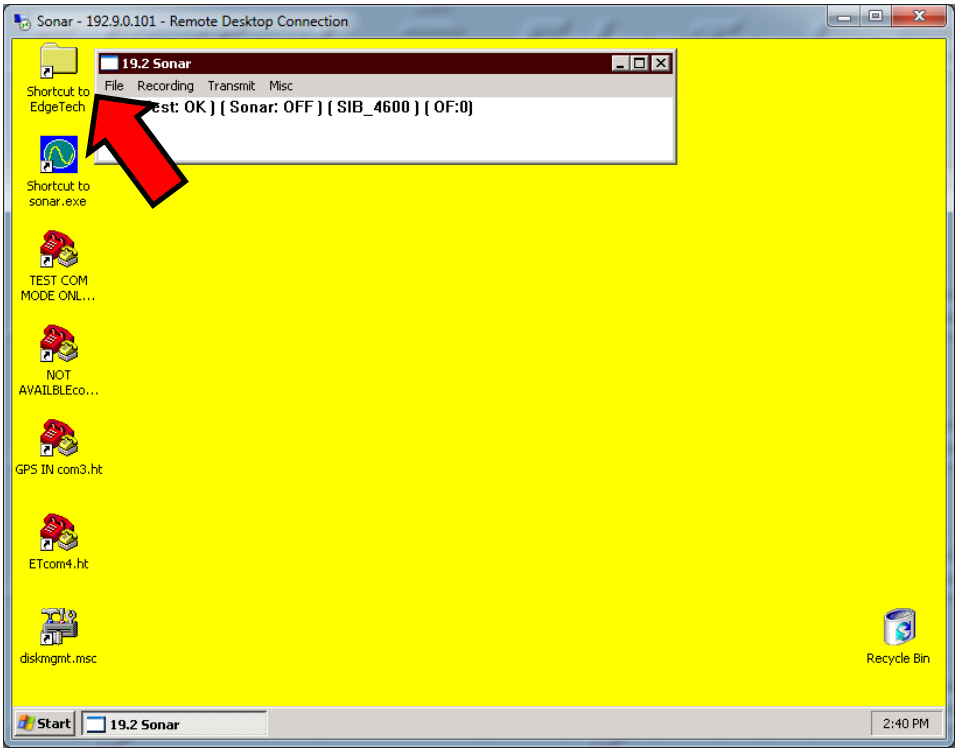


Figure: A-2: Sonar Remote Desktop, Shortcut to EdgeTech folder

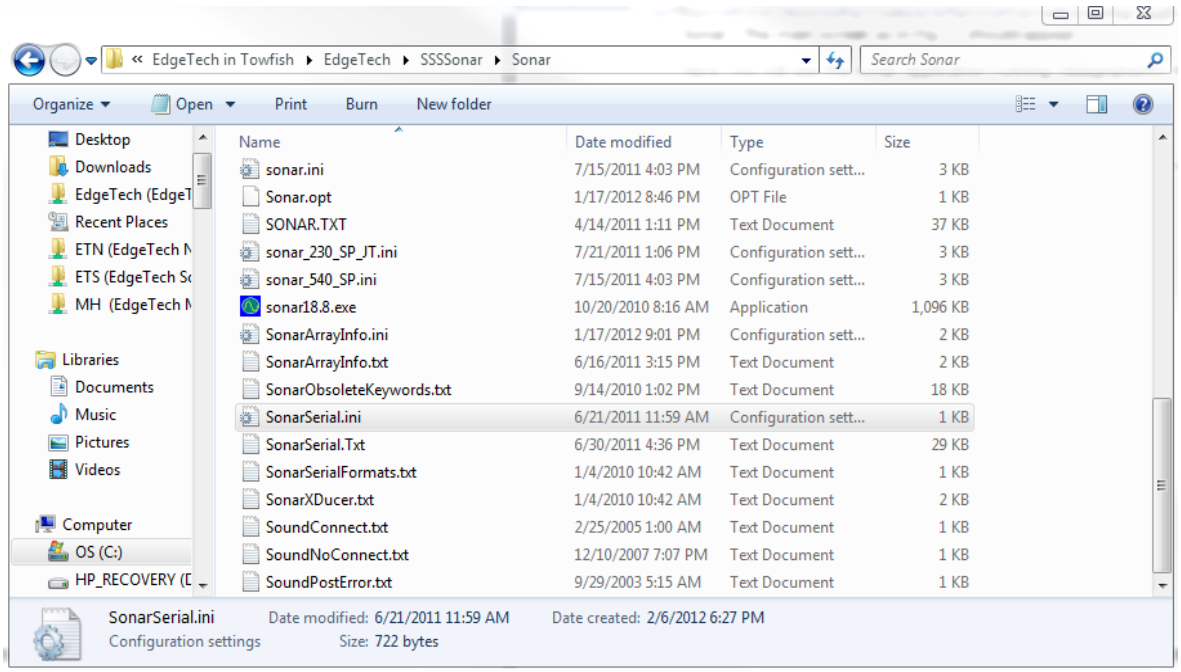

EdgeTech in Towfish ▸ EdgeTech ▸ SSSSonar ▸ Sonar
Search Sonar
Organize
Open
Print
Burn
New folder
Desktop
Downloads
Recent Places
Libraries
Documents
Music
Pictures
Videos
Computer
OS (C:)
Name
Date modified
Type
Size
sonar.ini 7/15/2011 4:03 PM Configuration sett... 3 KB
Sonar.opt 1/17/2012 8:46 PM OPT File 1 KB
SONAR.TXT 4/14/2011 1:11 PM Text Document 37 KB
sonar_230_SP_JT.ini 7/21/2011 1:06 PM Configuration sett... 3 KB
sonar_540_SP.ini 7/15/2011 4:03 PM Configuration sett... 3 KB
sonar18.8.exe 10/20/2010 8:16 AM Application 1,096 KB
SonarArrayInfo.ini 1/17/2012 9:01 PM Configuration sett... 2 KB
SonarArrayInfo.txt 6/16/2011 3:15 PM Text Document 2 KB
SonarObsoleteKeywords.txt 9/14/2010 1:02 PM Text Document 18 KB
SonarSerial.ini 6/21/2011 11:59 AM Configuration sett... 1 KB
SonarSerial.Txt 6/30/2011 4:36 PM Text Document 29 KB
SonarSerialFormats.txt 1/4/2010 10:42 AM Text Document 1 KB
SonarXDucer.txt 1/4/2010 10:42 AM Text Document 2 KB
SoundConnect.txt 2/25/2005 1:00 AM Text Document 1 KB
SoundNoConnect.txt 12/10/2007 7:07 PM Text Document 1 KB
SoundPostError.txt 9/29/2003 5:15 AM Text Document 1 KB
SonarSerial.ini Date modified: 6/21/2011 11:59 AM Date created: 2/6/2012 6:27 PM
Configuration settings Size: 722 bytes

Figure A-3: Finding the SonarSerial.ini file

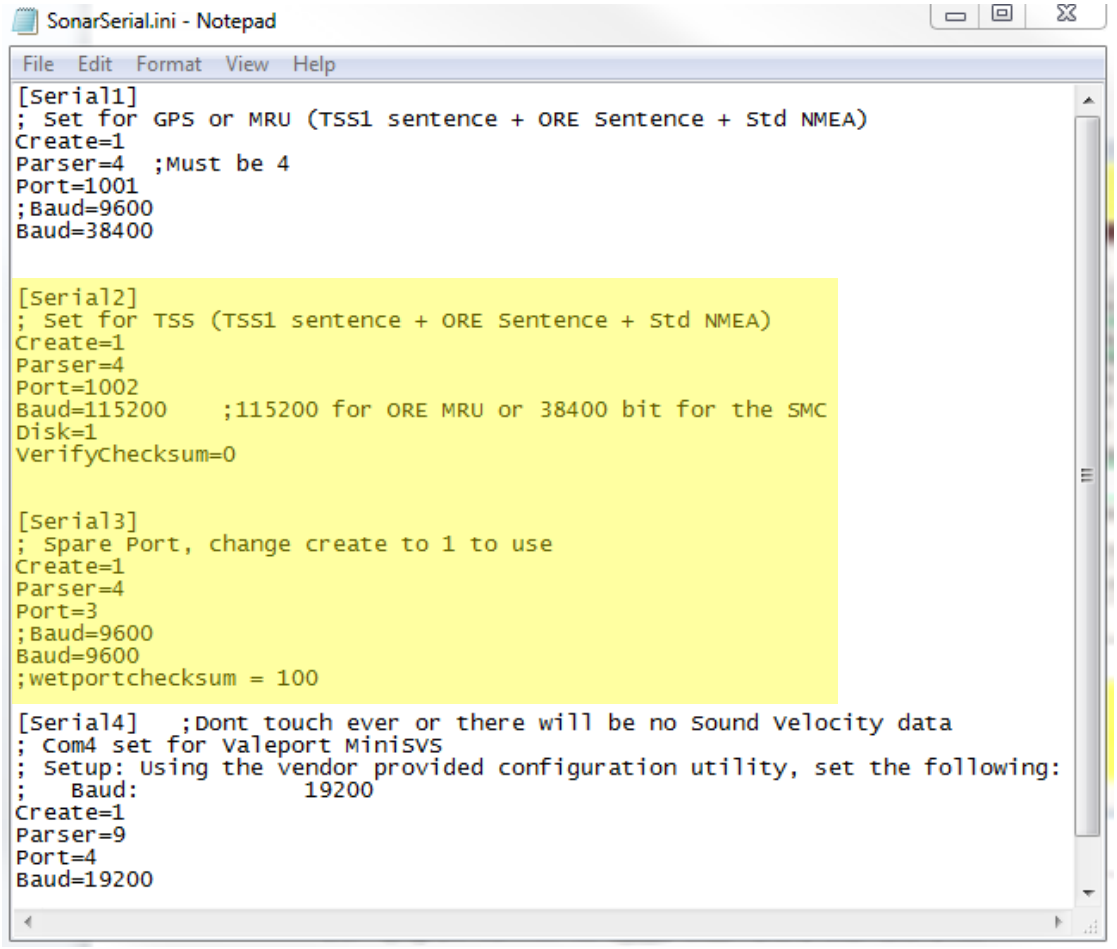


Figure A-4: SonarSerial.ini File

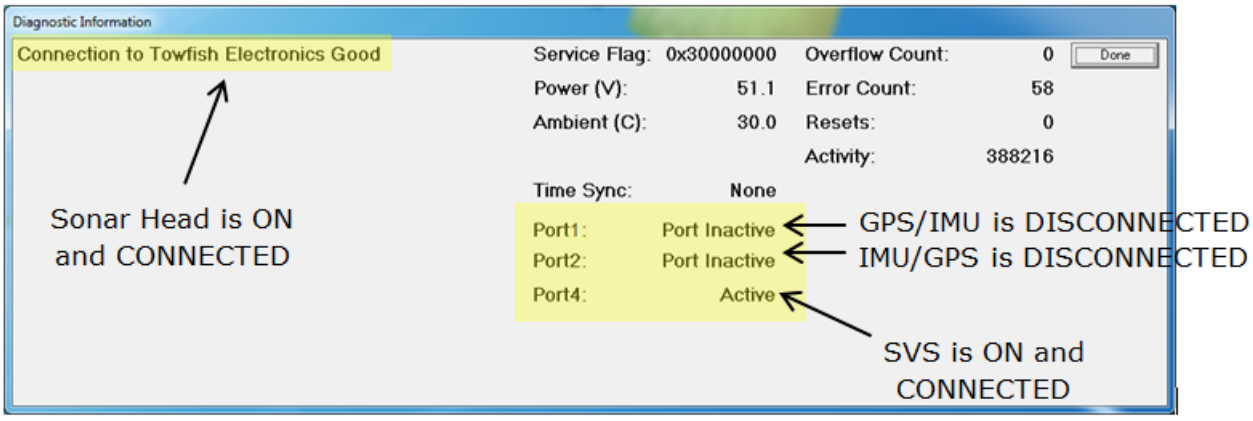


Figure A-5: Diagnostic Window, Reporting Ports Inactive Error

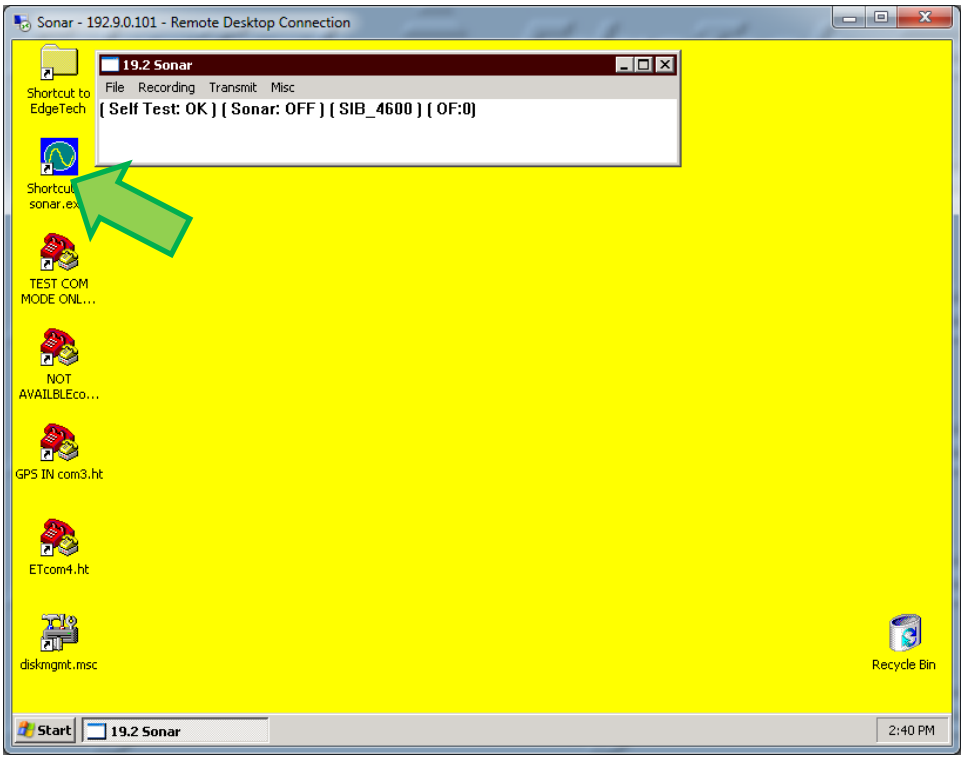


Figure A-6: Rebooting Sonar from the main screen

8. Now, plug in your device into COM 1.

9. Click on the **Misc.** at the top of the Sonar screen (as shown in Figure A-7), then **Serial Port Information…**

10. Check COM1 and set the correct baud rate for that device by using the drop down menu shown in blue (Figure A-7). When the correct baud rate is set, the **State** should say **OK** and **Errors** should not be increasing (as circled in green, Figure A-7). The correct data string should also be scrolling in the lower part of the window (green arrow, Figure A-7).

11. Now click on **File** > **Show Status** in the sonar window (circled in red, Figure A-8).

12. On the right hand side of the window, click on the **Config** bullet under the **Update** button and then on the drop down menu named **Config Item** (in green).

13. Select **Serial** and then click on the **Update** button several times (blue arrow).

14. Check to make sure the sensor's usage percentage is well below 80% (circled in purple). If it is not, increase the baud rate of the sensor, change the baud rate under Serial Port Information as done before in step 10, and check the Status again, otherwise the sonar will report errors.

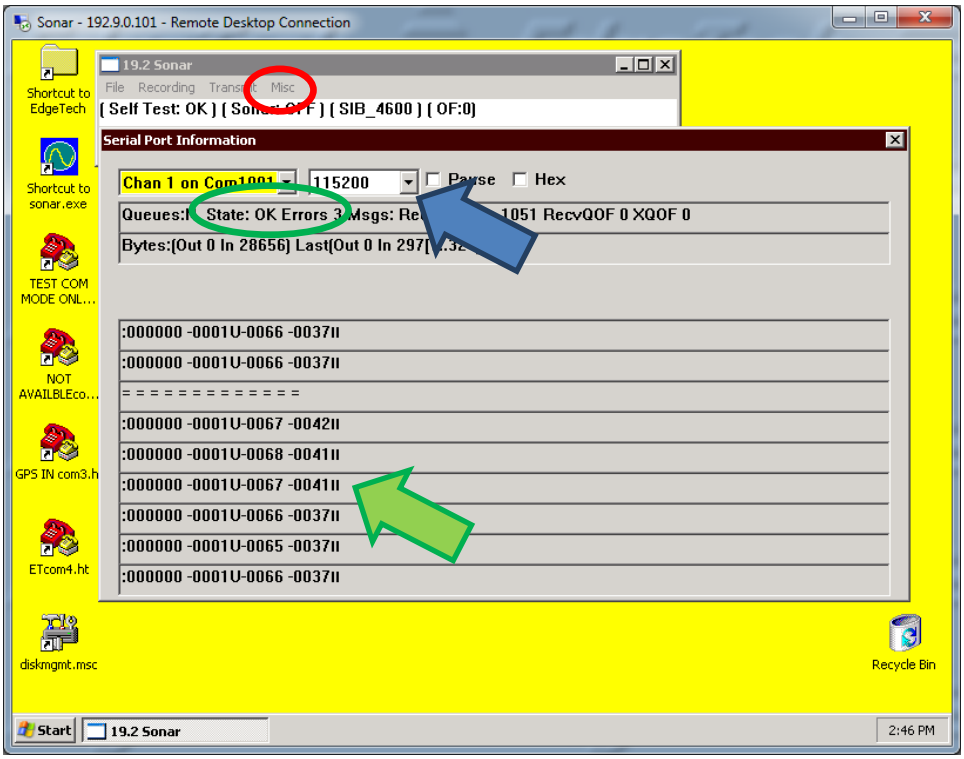


Figure A-7: Checking Serial Port Information

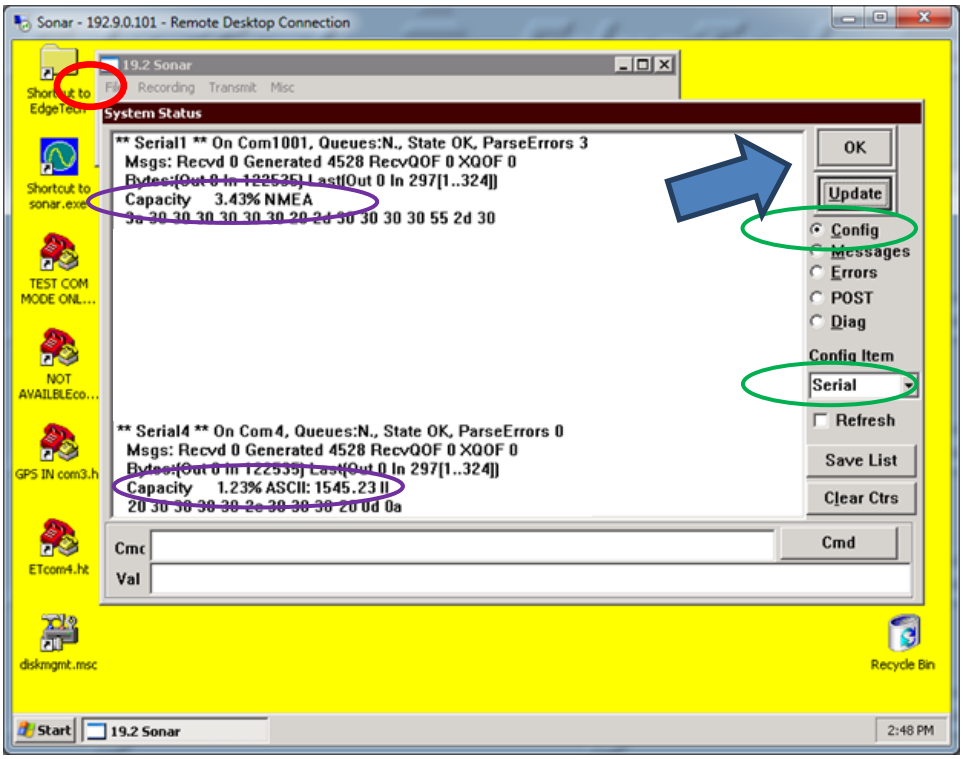


Figure A-8: Checking Sensor Status

15. When satisfied with the incoming data, press **OK** in the System Status window (Figure A-9).

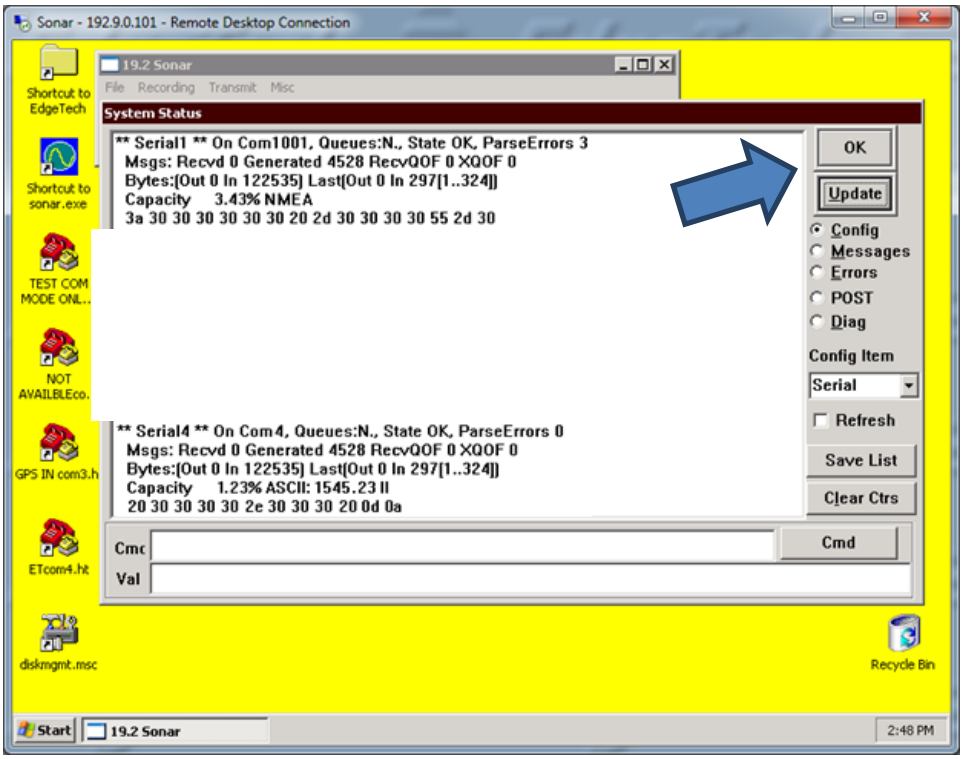


Figure A-9: Closing the System Status Window

16. Finally, close the Sonar – 192.9.0.101 – Remote Desktop Connection window.

    If this window is left open during data acquisition, the user may experience a very slow computer. This is because the remote desktop application uses a large amount of the link capacity to stay open. So it is always a good idea to close the remote desktop application when finished with the configurations.

A.2 Two Sensors

Two sensors, such as a dual headed GPS (heading, position, and time source) and a Motion Reference Unit (roll, pitch, and heave) may be used to supply the necessary information. For this type of configuration, only COM1 and COM2 will be utilized.

To configure the COM ports for the two sensors, the following steps should be carried out.

1. Follow steps (1.) through (6.) as stated previously under Section A.1.

2. Under [Serial3] set Create = 0, select *File* > *Save*, and close the file (Figure A-10). DO NOT TOUCH ANYTHING ELSE!

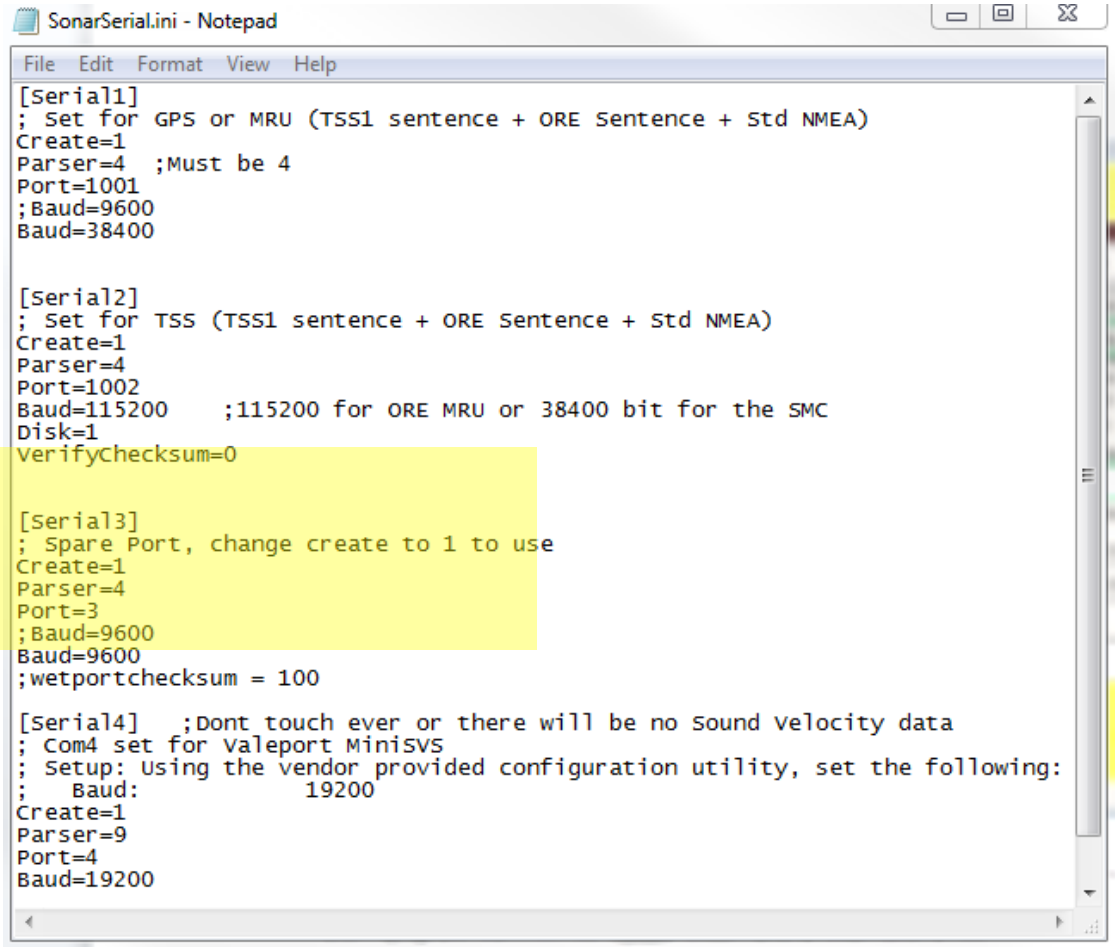


Figure A-10: SonarSerial.ini File

This will deactivate COM3. By deactivating this port, Sonar will report to DISCOVER that only two sensors are to be used on COM1 and COM 2 to parse the necessary sensor information. Therefore, DISCOVER will not throw up any errors if a sensor is not connected to COM3.

3. Close the SonarSerial.ini file and reboot the Sonar Firmware by double clicking on the Sonar icon in the main Sonar Remote Desktop Screen (designated by the green arrow in Figure A-6).

4. Now, plug in your devices into COM 1 and COM 2. Which device is connected to which COM port does not matter, as long as their respective ports and baud rates are noted.

5. Click on the **Misc.** at the top of the Sonar screen (as shown in Figure A-7), then **Serial Port Information…**

6. Check COM1 and set the correct baud rate for that device by using the drop down menu shown in blue (Figure A-7). When the correct baud rate is set, the **State** should say **OK** and **Errors** should not be increasing (as circled in green, Figure A-7). The correct data string should also be scrolling in the lower part of the window (green arrow, Figure A-7).

7. Now Check COM2 and set the correct baud rate for the other device as done before in Step 6.

8. Now click on **File** > **Show Status** in the sonar window (circled in red, Figure A-8).

9. On the right hand side of the window, click on the **Config** bullet under the **Update** button and then on the drop down menu named **Config Item** (in green, Figure A-8).

10. Select **Serial** and then click on the **Update** button several times (blue arrow, Figure A-8).

11. Check to make sure the sensors' usage percentages are well below 80% (circled in purple, Figure A-11). If they are not, increase the baud rate of the sensor, change the baud rate under **Serial Port Information** as done before in steps 6 and 7, and check the **Status** again, otherwise the sonar will report errors.

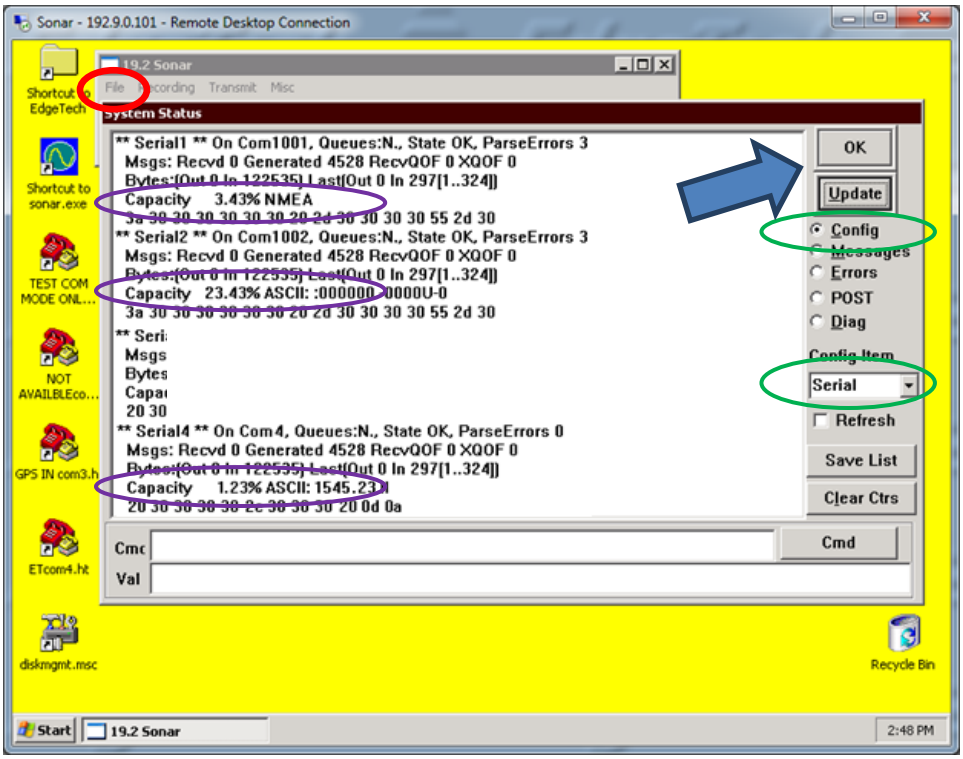


Figure A-11: Checking Sensors' Usages

12. When satisfied with the incoming data, press **OK** in the System Status window (Figure A-11).

13. Finally, close the Sonar – 192.9.0.101 – Remote Desktop Connection window.

If this window is left open during data acquisition, the user may experience a very slow computer. This is because the remote desktop application uses a large amount of the link capacity to stay open. So it is always a good idea to close the remote desktop application when finished with the configurations.

A.3 Three Sensors

Three sensors, such as a gyro (heading), a GPS (position, and time source) and a Motion Reference Unit (roll, pitch, and heave) may be used to supply the necessary information. For this type of configuration, all available COM ports will be utilized.

To configure the COM ports for the three sensors, the following steps should be carried out.

1. Follow steps (1.) through (6.) as stated previously under Section A.1.

2. Make sure **Create** under each [Serial#] description is set to 1 (Create = 1) (Figure A-12).

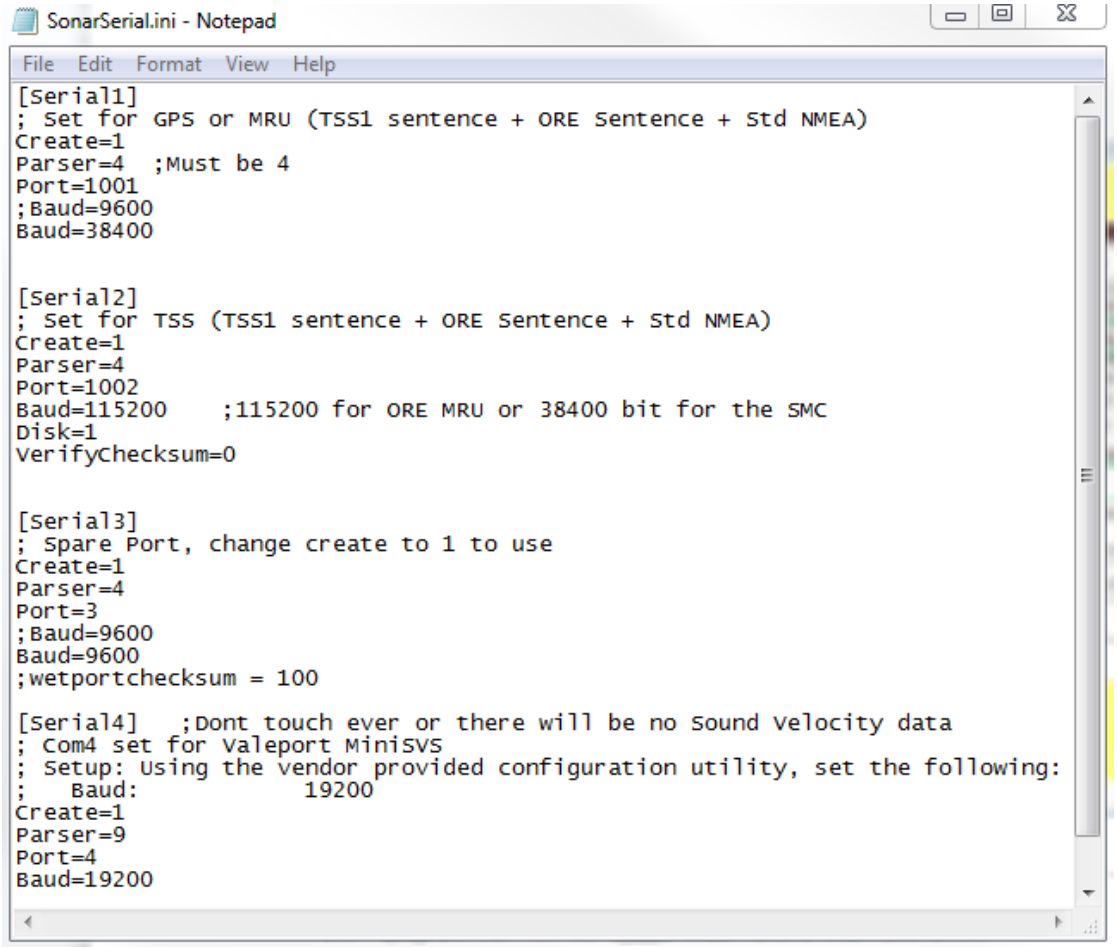


Figure A-12: All Sensors Set

3. Then select *File* > *Save*, and close the file. **Do not** change any other settings.

4. Close the SonarSerial.ini file and reboot the Sonar Firmware by double clicking on the Sonar icon in the main Sonar Remote Desktop Screen (designated by the green arrow in Figure A-6).

5. Now, plug in your devices into COM 1, COM 2, and COM 3. The Gyro should be connected to COM1, the MRU COM2, and the GPS to COM3. The devices connected to COM1 or COM2 may be interchanged but the GPS must be connected to COM3.

6. Click on the **Misc.** at the top of the Sonar screen (as shown in Figure A-7), then **Serial Port Information…**

7. Check COM1 and set the correct baud rate for that device by using the drop down menu shown in blue (Figure A-7). When the correct baud rate is set, the **State** should say **OK** and **Errors** should not be increasing (as circled in green, Figure A-7). The correct data string should also be scrolling in the lower part of the window (green arrow, Figure A-7).

8. Now check COM2 and set the correct baud rate for the other device as done before in Step 6.

9. Also, remember to check COM3 as before and set the correct baud rate for GPS.

10. Now click on **File** > **Show Status** in the sonar window (circled in red, Figure A-8).

11. On the right hand side of the window, click on the **Config** bullet under the **Update** button and then on the drop down menu named **Config Item** (in green, Figure A-8).

12. Select **Serial** and then click on the **Update** button several times (blue arrow, Figure A-13).

13. Check to make sure the sensors' usage percentages are well below 80% (circled in purple, Figure A-13). If they are not, increase the baud rate of the sensor, change the baud rate under Serial Port Information as done before in steps 6 and 7, and check the Status again, otherwise the sonar will report errors.

14. When satisfied with the incoming data, press **OK** in the System Status window (Figure A-13).

15. Finally, close the Sonar – 192.9.0.101 – Remote Desktop Connection window.

If this window is left open during data acquisition, the user may experience a very slow computer. This is because the remote desktop application uses a large amount of the link capacity to stay open. So it is always a good idea to close the remote desktop application when finished with the configurations.

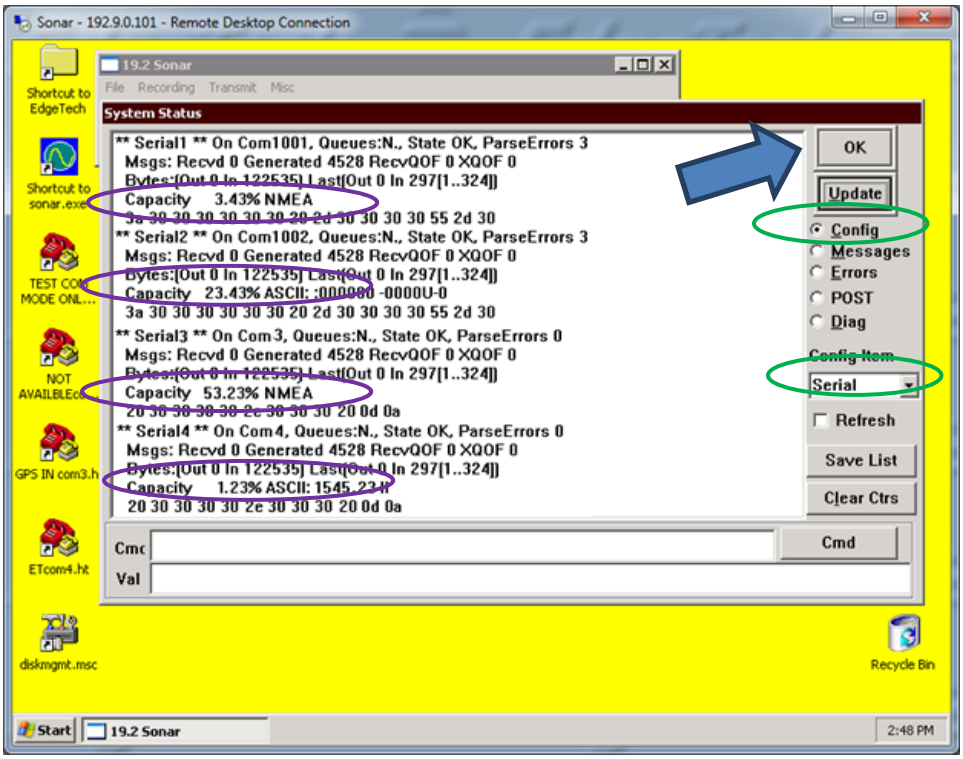

Sonar - 192.9.0.101 - Remote Desktop Connection
19.2 Sonar
File Recording Transmit Misc
System Status
** Serial1 ** On Com1001, Queues:N., State OK, ParseErrors 3
Msgs: Recvd 0 Generated 4528 RecvQOF 0 XQOF 0
Capacity 3.43% NMEA
** Serial2 ** On Com1002, Queues:N., State OK, ParseErrors 3
Msgs: Recvd 0 Generated 4528 RecvQOF 0 XQOF 0
3a 30 30 30 30 30 30 20 2d 30 30 30 30 55 2d 30
** Serial3 ** On Com3, Queues:N., State OK, ParseErrors 0
Msgs: Recvd 0 Generated 4528 RecvQOF 0 XQOF 0
Capacity 53.23% NMEA
20 30 30 30 30 2e 30 30 30 20 0d 0a
** Serial4 ** On Com4, Queues:N., State OK, ParseErrors 0
Msgs: Recvd 0 Generated 4528 RecvQOF 0 XQOF 0
Capacity 1.23% ASCII: 1545.23 #
20 30 30 30 30 2e 30 30 30 20 0d 0a
OK
Update
Config
Messages
Errors
POST
Diag
Serial
Refresh
Save List
Clear Ctrs
Cmd
Cmd
Val
Shortcut to EdgeTech
Shortcut to sonar.exe
GPS IN com3.h
ETcom4.ht
diskmgmt.msc
Recycle Bin
Start
19.2 Sonar
2:48 PM

Figure A-13: Checking all COM Ports

APPENDIX B: PERFORMING A RUB TEST

This test is carried out on a bench or work table and is used to indicate if the receive section of the Sonar Arrays is working properly. This section states how a Rub Test should be performed.

> **NOTE 1:** *If the Rub Test fails, please contact EdgeTech immediately using the provided information in the* **EdgeTech Customer Service***.*
>
> **NOTE 2:** *In this section, it is assumed that the 4600 Topside Processor, monitors, keyboard, and mouse are all connected and powered on. If this has not been done yet, please do so at this moment.*

1. Ensure the Ethernet from Port1 of the 4600 Topside Interface is plugged into the Ethernet Port1 of the Topside Processor (labeled SONAR).

Turn the Sonar Head ON by using the switch on the front side of the 4600 Sonar Interface.

> **NOTE:** *If the Topside Interface does not turn ON, check to see if the switch next to the power cable (on the back of the Topside Unit) is in the ON position. If not, flip the switch to the ON position.*

2. Wait several minutes. This waiting period allows the Sonar Head's Processing Unit to connect with the Topside Processor.
3. Launch JSTAR using the shortcut on the Desktop, or alternatively, navigate to C:\EdgeTech\JSTAR4600 and launch the JSTAR Application. The main window will appear with 8 cells (Figure B-1). These cells correspond to each coupled port and starboard channels.

> **NOTE:** *If the window that appears does not resemble Figure B-1, please load the configuration file by File > Load Configuration > JStar_4600_Rub Test.jni.*

4. Ensure the Sonar Head is connected to JSTAR by checking that the network is on (**NET: ON**) in the bottom right hand corner of the window.

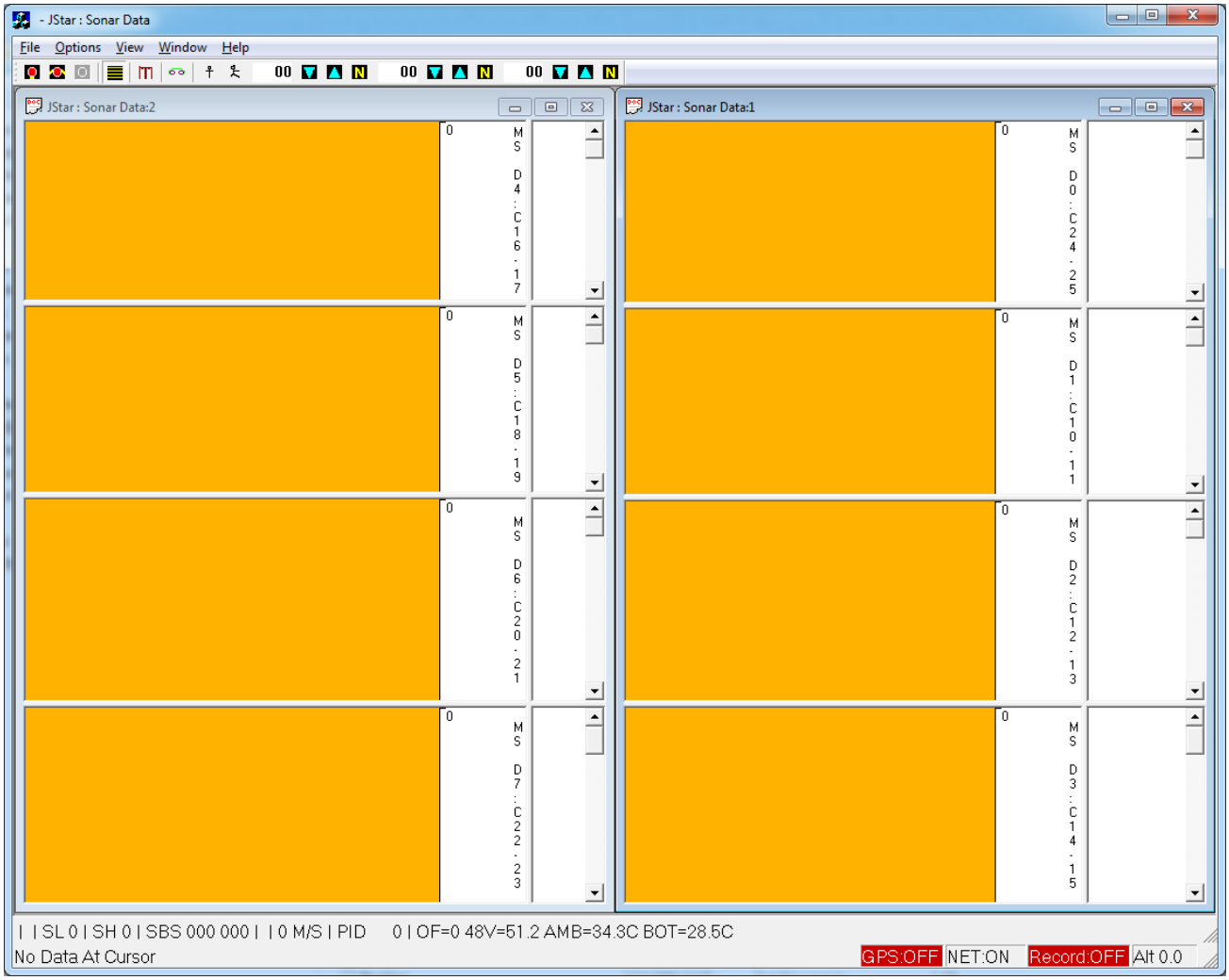


Figure B-1: JSTAR Startup Window

5. Click on the icon to open up the **Status and Control Window** (Figure B-2).

6. Select the **4600** tab and check the **Ping On** box under the Transmit section. This will engage the 4600 Sonar Head to start receiving signals.

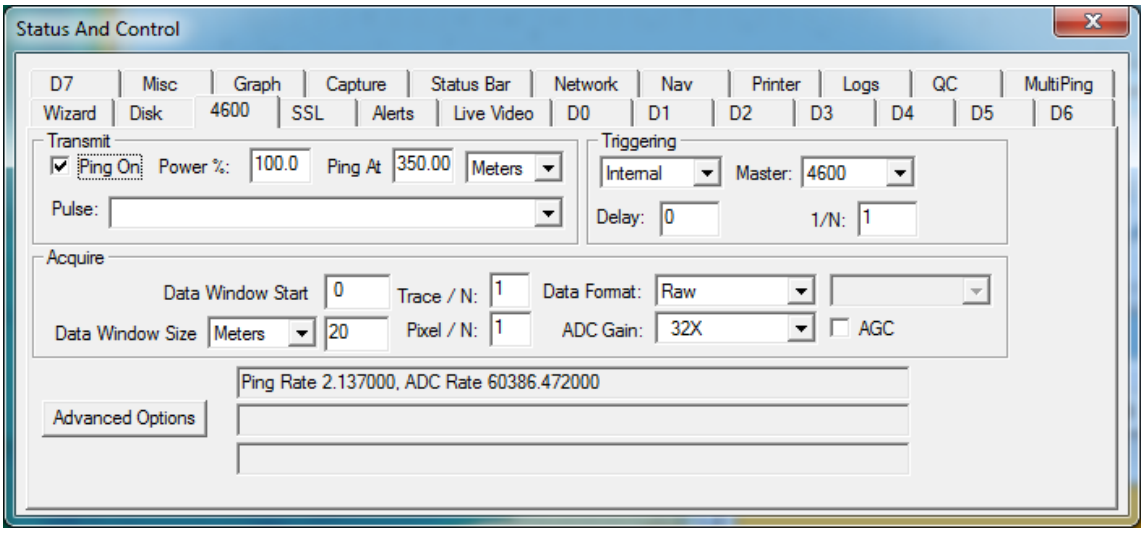


Figure B-2: JSTAR Status and Control Window

7. Rub your hand vigorously across the face of the Port Array for 3 seconds and observe the response in JSTAR.

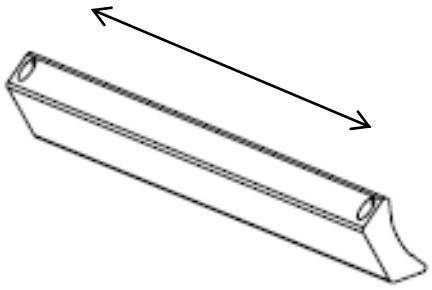


Figure B-3: Array – Rub Test

8. Repeat the Rub Test for the Starboard Array. If the response in JSTAR resembles Figure B-4, then the Arrays have passed. If any channels do not respond (as in the example illustrated in Figure B-5), please contact **EdgeTech Customer Service**.

9. Exit out of JSTAR when finished, as this will cause a network conflict between JSTAR and DISCOVER if both programs are trying to run at the same time.

NOTE 1: *Each cell is split in half by a yellow line. Above this yellow line corresponds to the Port side channels and below this line corresponds to the Starboard channels.*

NOTE 2: *Each cell also represents the different elements for each array (see Figure B-4 and Figure B-5 for element assignment.)*

Port Receive Signals
Starboard Receive Signals
CH 4
CH 5
CH 6
CH 7
CH 0
CH 1
CH 2
CH 3
File Options View Window Help
0:00.0000 N 0:00.0000 E | (0.0kt 0d) | SL 1273 | SH 0 | SBS 000 000 | No Pitch Roll | 0 M/S | PID 0 | OF=0 48V=51.1 AMB=35.0C BOT=30.9C
Press Left Mouse Button for More
GPS:OFF
NET:ON
Record:OFF
Alt 0.0

Figure B-4: Rub Test for 4600 Port and Starboard Arrays (PASSED)

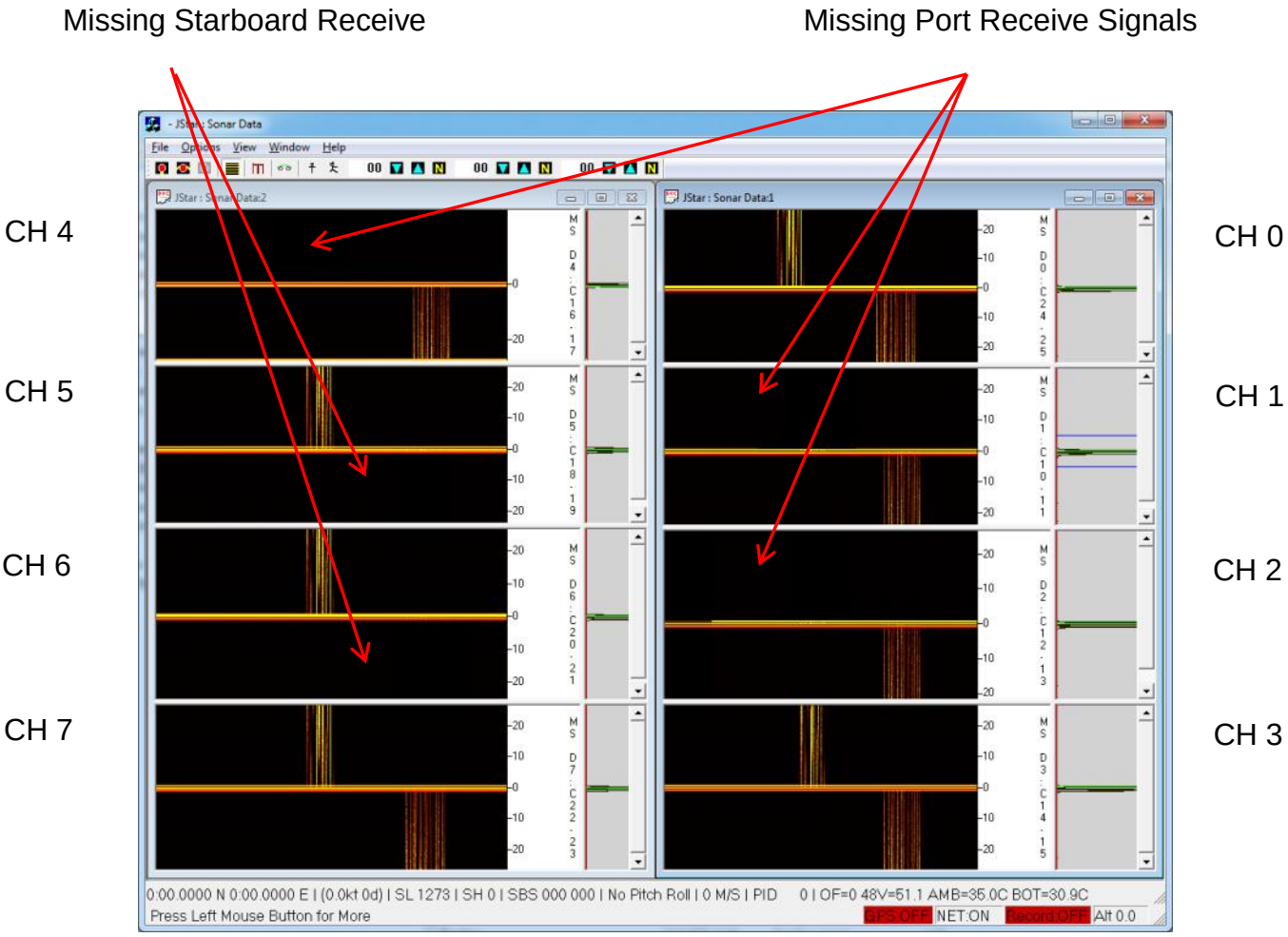


Figure B-5: Rub Test for 4600 Port and Starboard Arrays (FAILED)

APPENDIX C: DIAGRAMS

This section contains diagrams of the wiring and acoustic centers for the 4600 system.

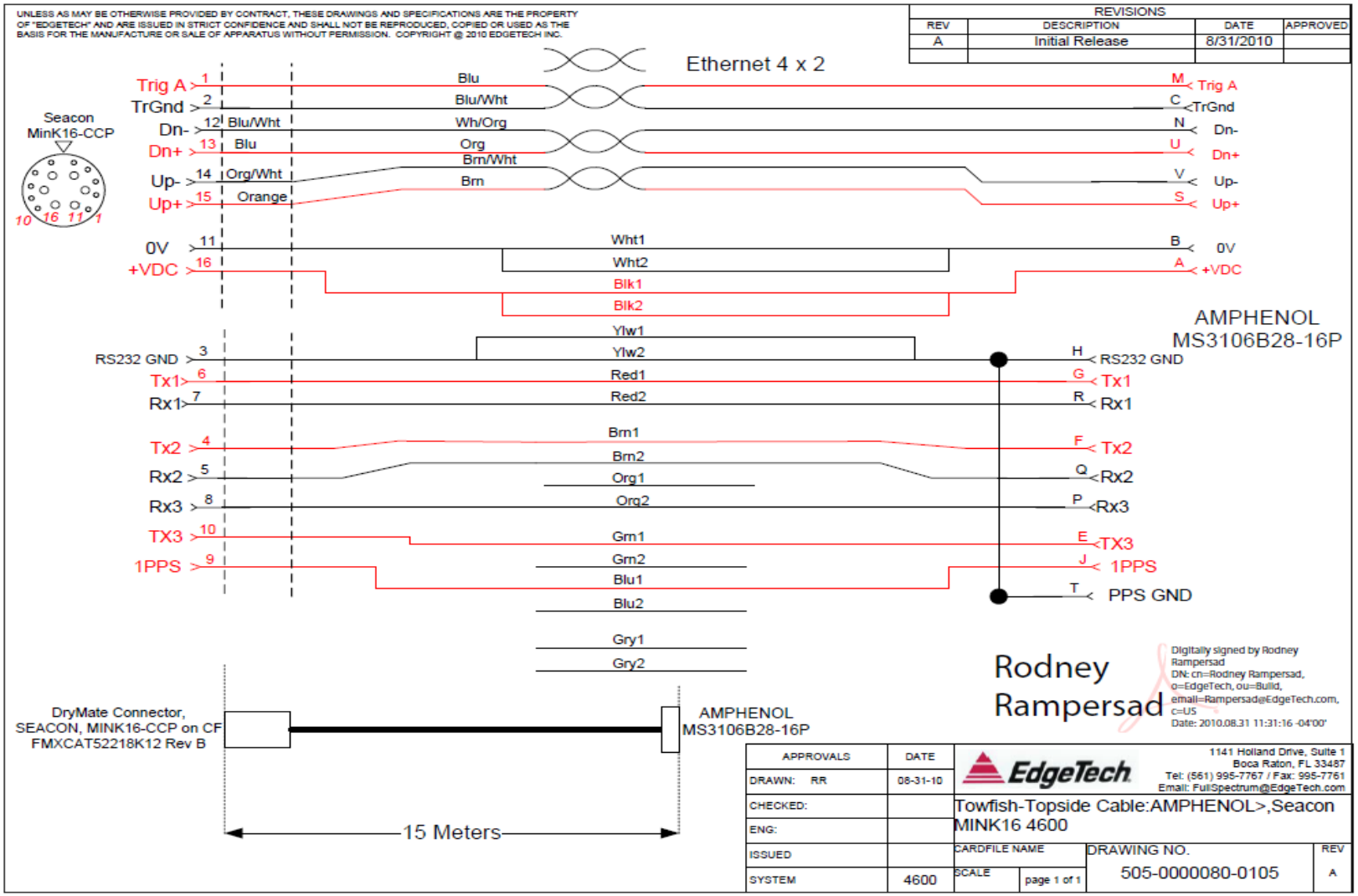


Figure C-1: Terminated Deck Cable Wiring Diagram

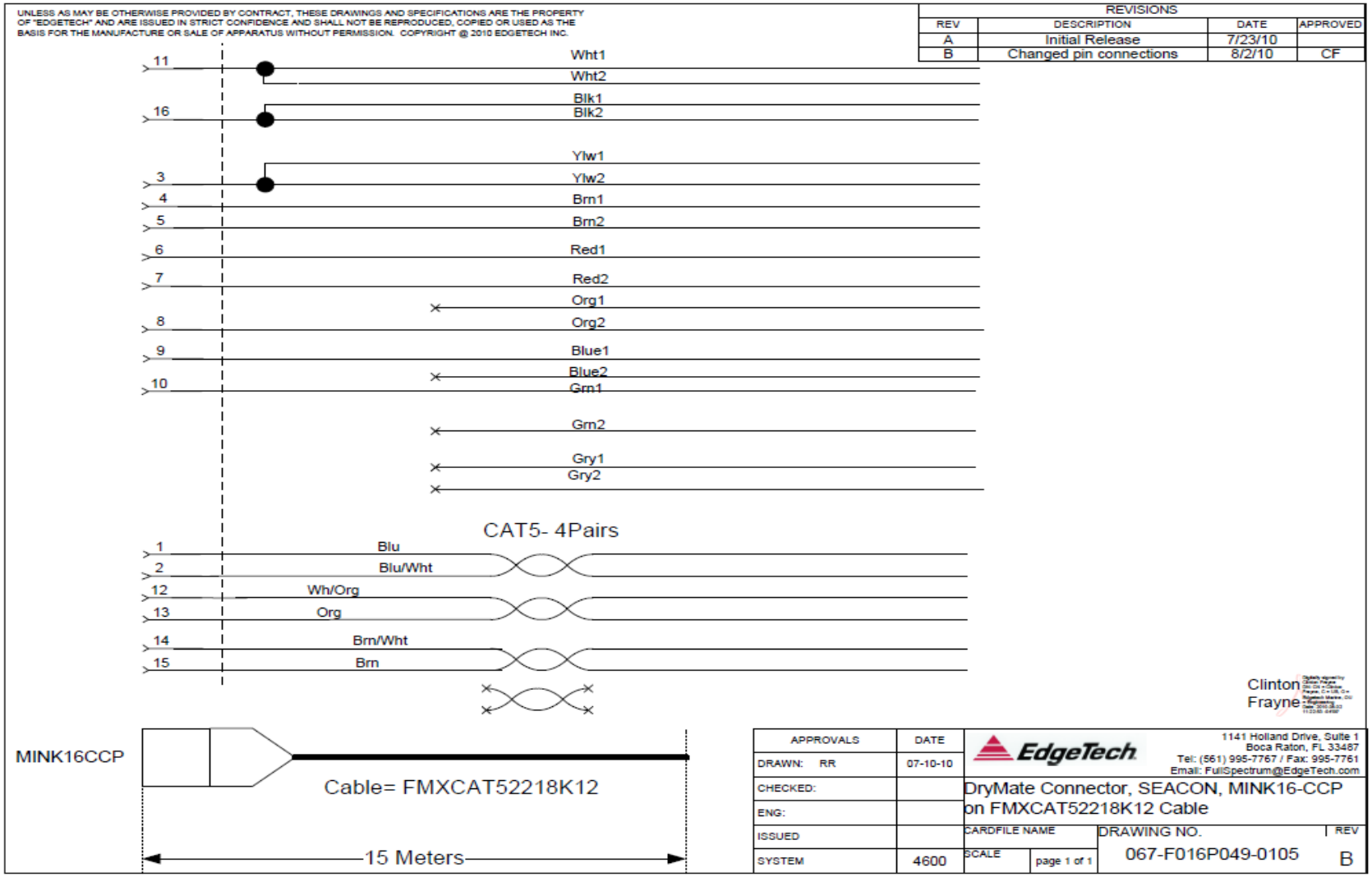


Figure C-2: Large Figure Caption

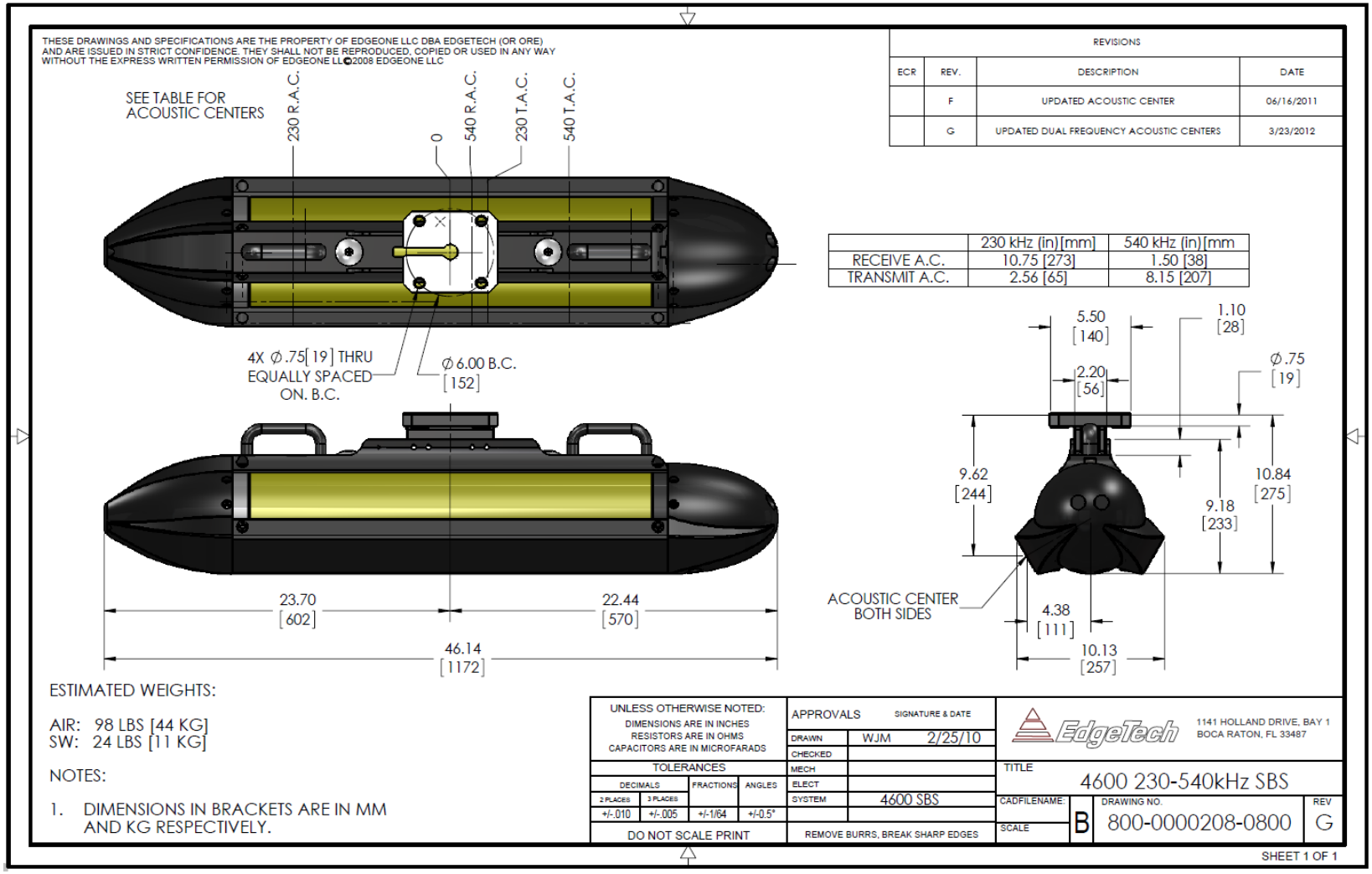
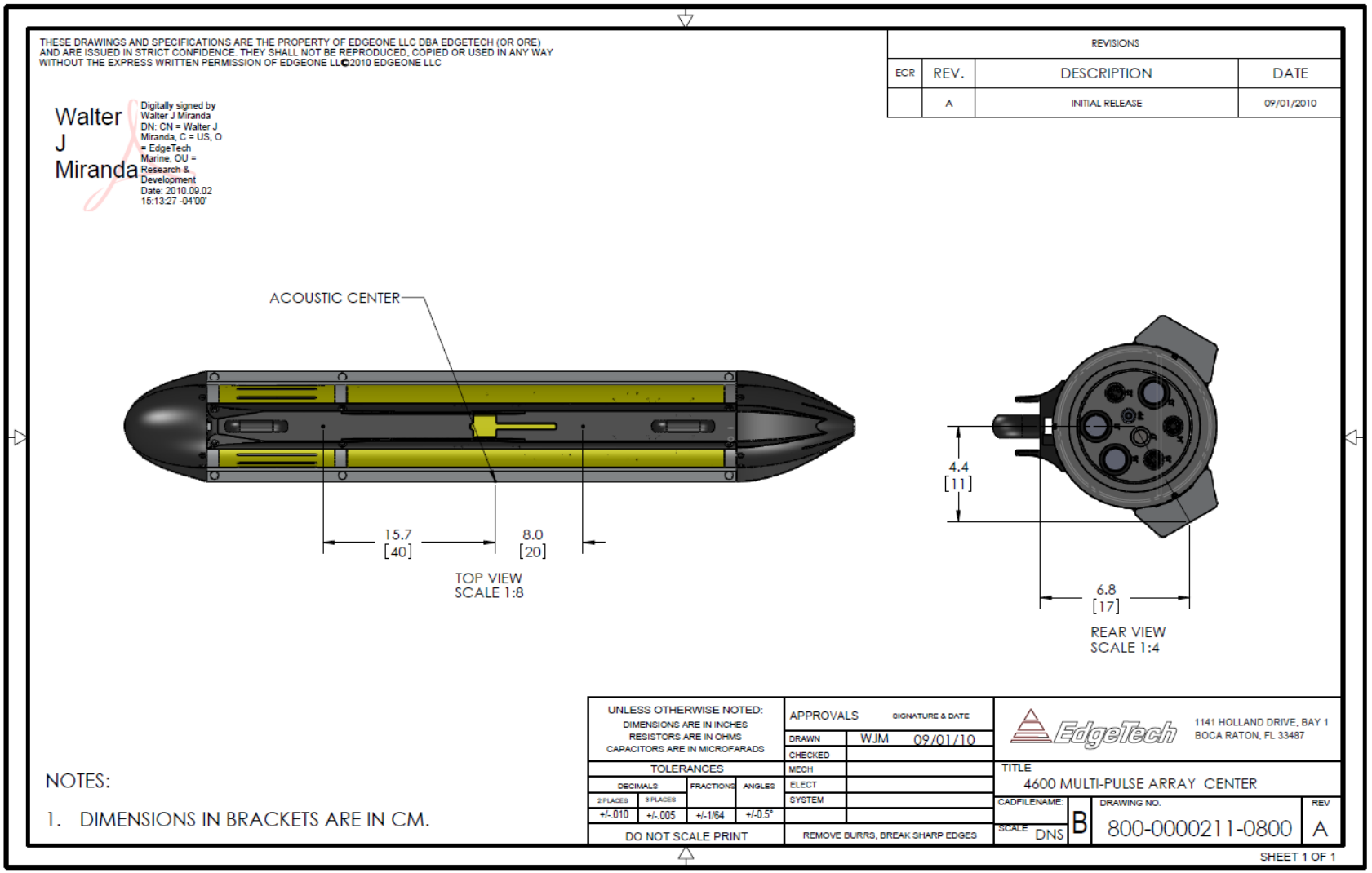


Figure C-3: Acoustic Centers (Standard Body Type)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REVISIONS
ECR REV. DESCRIPTION DATE
A INITIAL RELEASE 09/01/2010
Walter J Miranda
Digitally signed by Walter J Miranda
DN: CN = Walter J Miranda, C = US, O = EdgeTech Marine, OU = Research & Development
Date: 2010.09.02 15:13:27 -04'00'
ACOUSTIC CENTER
15.7 [40]
8.0 [20]
TOP VIEW
SCALE 1:8
4.4 [11]
6.8 [17]
REAR VIEW
SCALE 1:4
NOTES:
1. DIMENSIONS IN BRACKETS ARE IN CM.
UNLESS OTHERWISE NOTED:
DIMENSIONS ARE IN INCHES
RESISTORS ARE IN OHMS
CAPACITORS ARE IN MICROFARADS
TOLERANCES
DECIMALS 2 PLACES +/-.010 3 PLACES +/-.005
FRACTIONS +/-1/64
ANGLES +/-0.5°
DO NOT SCALE PRINT
APPROVALS SIGNATURE & DATE
DRAWN WJM 09/01/10
CHECKED
MECH
ELECT
SYSTEM
REMOVE BURRS, BREAK SHARP EDGES
EdgeTech
1141 HOLLAND DRIVE, BAY 1
BOCA RATON, FL 33487
TITLE
4600 MULTI-PULSE ARRAY CENTER
CADFILENAME:
SCALE DNS
B
DRAWING NO. 800-0000211-0800
REV A
SHEET 1 OF 1

Figure C-4: Acoustic Centers (Long Body Type, 230 kHz Only)